THE UNIVERSITY OF CALGARY

The Nature of Anaesthesia Residency Education in the Operating Room at The University of Calgary

by

Alexander John Shysh

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF SCIENCE

DEPARTMENT OF MEDICAL SCIENCE

CALGARY, ALBERTA

DECEMBER, 1996

Abstract

A paucity of information exists regarding anaesthesia residency education in the operating room. Therefore, this primary learning context for the anaesthesia resident was explored using survey research methods. Faculty and resident anaesthetists gave their opinions on the importance of factors relating to four thematic areas including student classroom learning principles, adult learning principles, cognitive apprenticeship methodology, and the mechanics of the learning encounter. No single factor was deemed solely responsible for promoting student learning outcomes. Numerous factors of importance were determined, especially those proximal to the student-teacher interaction such as motivation and willingness to teach and learn. Students and teachers each placed responsibility for student learning on their counterpart, an interesting finding in terms of andragogy. The factors of importance, as established in this study, will allow for specific improvement efforts directed to those areas that will most greatly enhance student learning outcomes in this unique learning context.

Acknowledgments

I wish to acknowledge the financial support from the Royal College of Physicians and Surgeons of Canada (RCPSC) by means of the 1995 RCPSC Fellowship in Medical Education. The opinions expressed do not necessarily reflect the position of the RCPSC and no official endorsement should be inferred.

I wish to gratefully acknowledge the assistance of several of my mentors throughout my medical education training including Dr. Penny Jennett, Dr. Peter Harasym, Dr. Tom Gougeon, Dr. John Baumber, and Ms. Carol Gerein as well as the support of the Medical Education Research Group at The University of Calgary.

I wish to acknowledge the kind assistance of my fellow department of anaesthesia members, both faculty and residents, who so willingly responded to my lengthy questionnaires. Their interest in medical education is admirable and their comments proved invaluable. The support of my department chair and thesis supervisor, Dr. Chris Eagle, deserves special thanks.

I am deeply indebted to my family, especially my wife Maria, for their encouragement throughout this research project.

Table of Contents

Table of Contents (continued)

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION

Education in Anaesthesia

The educational process involves the presentation of new skills, attitudes, and knowledge to the learner for incorporation into his or her methods, manners, or practices to achieve a change in behavior or an enhanced level of scholarship. The presentation of these new skills, attitudes, and knowledge to the learner commonly involves a student-teacher relationship. While a strict model of the teacher lecturing to students is usually implied in such a relationship, this necessarily need not be the case. The student, and especially adult learners, may seek out and present himself or herself with this new information, as this is only human nature. Fostering and promoting the student's educational processes may be the task of greatest importance for the teacher. Learning does not end with the completion of a structured course, but rather is a continual, lifelong process.

Considering the context of anaesthesia, Schwarz (1990) stated that the purpose of education in anaesthesia is

> to provide a common set of learning experiences that when mastered by students will lead to relatively standardized behaviors. These standards (minimum standards though they may be) become the criteria by which a student candidate can be evaluated for entry into a specified mastery level. (pp. 2373-4)

Traditionally, education for the anaesthesia resident takes place in the context of either a formal classroom setting or in the operating room. The classroom educational experiences rely on didactic lectures presented by staff anaesthetists to a group of anaesthesia residents for the purpose of transfer of knowledge. The operating room educational experiences are one-on-one interactions between a staff anaesthetist and an individual anaesthesia resident. Hands-on experience in the operating room allows for

skills training. Prys-Roberts and coworkers (1988) have described the process of anaesthesia education:

> An introductory course of lectures complemented by audiovisual aids and practical experience on . . . models ensure a theoretical grounding. Personalized programmes, such that a student receives individual tuition from anaesthetists in the operating theatre and on the wards, maximize experience in many practical procedures and illustrate a multitude of physiological, pharmacological and pathological processes. Only one-to-one teaching provides this optimum opportunity for thorough explanations and a full understanding of these processes. (p. 357)

This "individual tuition" of an anaesthesia resident in the operating room by a veteran practitioner appears to be most important for the process of anaesthesia education.

A definite challenge currently exists in the training of the anaesthesia resident in the operating room setting. Unfortunately, little is known about the teaching and learning processes which take place between the teacher and student in this busy and harsh learning environment, even though this is the learning context in which the anaesthesia resident spends most of his or her time learning the art and the practice of the specialty. Perhaps it is the distinctive context of learning in this unique learning environment that makes teaching and learning in the operating room such a challenge.

CHAPTER TWO: LITERATURE REVIEW

Anaesthesia Education in the Operating Room

A review of the anaesthesia and medical education literature by a search of Medline® on SilverPlatter and the indexes of major anaesthesia journals was done to examine the results of research into anaesthesia education. The area of special interest that was selected was that of teaching and learning methods in the operating room setting. In total, only four articles were identified.

Paget, Lambert and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976) studied and described the general teaching methods for one-on-one teaching of anaesthesia in the operating room setting. From the outset, Paget and Lambert (1976) determined that

> the teaching of anaesthetics in the operating theatre involves both the tutor and student in an interaction which is different from that in any other setting. The main concern for both is the welfare of the patient, and as this task demands a considerable amount of attention any direct teaching or learning can be only a minor activity. (p. 301)

As well, the need for quietness during surgical procedures was identified as a constraint upon learning encounters in the operating room since much of the teaching relies upon discussions between the tutor and the student. The proper positioning of the teacher and the student in the operating room was described. A face-to-face orientation between the teacher and student without intervening equipment was suggested to promote improved communication. Information from the face regarding cues as to comprehension, or lack thereof, was thought to be greatly hindered by the use of operating room face masks. Thus, to compensate for the obstructive nature of the masks, it was suggested that enhanced expressions of the eyes and voice be used as well as supplementation with the increased use of head nods.

Two time phases for potential learning situations in the operating room were identified by Lambert and Paget (1976). The time during anaesthesia induction or the time during rapid change in the maintenance phase of anaesthesia was labeled as Phase I. The stable period of time during the maintenance phase of anaesthesia was labeled as Phase II. It was suggested that teaching in the operating room be restricted to only Phase II situations, and that the only type of learning to occur during Phase I situations be the learning-by-doing method. It was also suggested that teaching during Phase II situations be limited to simple topics and those topics that are related to the type of case or anaesthetic being undertaken at that particular time. In addition, it was suggested that the staff anaesthetist (teacher) take over the monitoring of the patient during the learning encounter.

Furthermore, Lambert and Paget (1976) showed that when a tutor is present with a student in the operating room, only 0-23% of the tutor's total time during a particular case was available for activities that were not oriented directly to patient care (and therefore available for a learning encounter with the student). When a student was assigned to a tutor in the operating room, Paget and Eaton (1977) showed that for a particular case, the tutor spent an average of 54.33% (range 4.39-100%) of their time actually in the operating room with the student. When looking at cases of 10 to 130 minutes in duration, they also found that of the total time teachers spent in the operating room with the student (average 26.75 minutes, standard deviation 20.93 minutes), the actual time spent on tutoring the student was on average 9.38 minutes (standard deviation 10.02 minutes). However, they found that the amount of time the student spent on vigilance and patient care during a case was not affected by the presence of a tutor. Thus, Paget and Eaton (1977) reported that in the operating room, "typically the tutor is present for only slightly more than half of the available time and interacts with the student for about one-third of that time" (p. 249).

Paget and Eaton (1977) concluded that "teaching can clearly be an appropriate activity in the operating theatre, but requires careful planning and a realistic coordination with the trainee's other responsibilities" (p. 250). More recent studies also have confirmed the variation in the level of the mental workload of the anaesthetist and the anaesthesia resident during a case in the operating room (Gaba, Herndon, Zornow, Weinger, & Dallen, 1991; Gaba & Lee, 1990). Times of high mental workload during a case may be inappropriate for teaching and learning. Both the teacher and learner may need to realize this fact and schedule learning encounters around these times.

In a recent review of anaesthesia education, Eagle (1992) discussed some teaching methods used in current anaesthesia education. Computer simulations and mannequins in the lecture theatre or workshop setting were discussed as potential useful methods for enhancing and preparing the learner for his or her operating room experiences. However, it was stated that "relatively little is known about the most effective operating room teaching" (Eagle, 1992, p. 161). What was suggested was the extrapolation of critical teaching steps from clinical instruction to the operating room setting:

> The first step is recognition of the learner's level of development or training. Next, expectations or objectives should be set for the encounter. The learner may then be questioned in a problem-solving fashion about the clinical case. Evaluative questions may help to probe the learner's comprehension and give direction to the teaching. Feedback from the student should be elicited, and finally, a summary of what was learned provided. This type of teaching requires the instructor to have both a high level of interest in the development of the student and mastery of knowledge in the area of interest. (Eagle, 1992, p. 161)

Overall, it was determined that there was need for further research into improvements and innovations in this underdeveloped field of study.

Major Themes

From the information available regarding anaesthesia education in the operating room, four major themes may be developed. First, since anaesthesia education in the operating room has been described as "individual tuition" with discussions and questioning techniques used for enabling the learning encounters, the issue is raised as to the factors that most greatly affect learning outcomes during learning encounters. A significant amount of research has been compiled as to the practices and influences that promote learning outcomes during learning encounters in the classroom setting for students from kindergarten to grade twelve (Cruickshank, 1990; Fraser et al., 1987a, 1987b; Porter & Brophy, 1988; Walberg, 1981, 1984, 1986; Wang et al., 1990, 1993, 1994; Waxman & Walberg, 1991; Wittrock, 1986). Some of these basic principles behind school learning also may be applicable to learning encounters in any setting, particularly the teaching and learning of anaesthesia in the operating room setting. However, the principles of school learning may not adequately encompass the entire spectrum of causal influences on the learning of an anaesthesia resident. This leads to the second theme.

Students of anaesthesia education in the operating room setting are members of postgraduate medical education programmes, not merely students in grade school. After completing three to four years of medical school, anaesthesia residents are mature students, usually in their third or fourth decade of life. Since anaesthesia residency education deals with adult learners becoming independently-practicing medical specialists, the principles of adult education (andragogy) may be important (see Brookfield, 1986, pp. 25-39; Cantor, 1992; Knowles, 1978, 1987; Merriam & Caffarella, 1991; Pratt, 1993; Zemke & Zemke, 1988). However, what is not known is the impact or importance of adult learning principles on anaesthesia education. Nor is it known if the

principles of adult education are being applied in proper fashion to anaesthesia residents learning in the operating room.

Third, since anaesthesia education in the operating room setting also involves the concurrent practice of administering anaesthetics and patient care, it may be described as on-the-job training. Coupled with on-the-job training is the caution that the job site may not be the ideal learning environment for all learning encounters. While little is known specifically about on-the-job training in anaesthesia, much is known about apprenticeship training in other fields (Barber, 1969; Bass & Vaughan, 1966; Basse, 1969; Beverstock, 1969; Burack & Smith, 1982; Connor, 1983; Craig & Bittel, 1967; Marsick, 1987; McCord, 1987; Moore, 1986; Simon, Dippo, & Schenke, 1991; Singer & MacDonald, 1970; Stokes, 1966). Knowledge with respect to other apprenticeship programs may suggest application to the context of anaesthesia training in the operating room. Unfortunately, it is not known if the principles of apprenticeship training are entirely applicable to anaesthesia education in the operating room. If they are applicable, it is not known if these principles are being carried out in an efficient and optimal way.

Furthermore, the instructional design concept of cognitive apprenticeship has been described (Collins, Brown, & Newman, 1989; Collins & Stevens, 1983; Wilson & Cole, 1991). Cognitive apprenticeship methods were originally described for the teaching of reading, writing, and mathematics (Collins, Brown, & Holum, 1991; Collins et al., 1989; Farmer, Buckmaster, & LeGrand, 1992; Wilson & Cole, 1991). As well, these methods have been applied to training in aviation (Farmer et al., 1992), engineering (Farmer et al., 1992), veterinary medicine (Farmer et al., 1992), pharmacy (LeGrand Brandt, Farmer, & Buckmaster, 1993), and orthopedic surgery (Farmer, Lippert, & Schafer, 1992; Lippert & Farmer, 1984). The cognitive apprenticeship theory of learning supports, yet expands upon, the notion of on-the-job or apprenticeship training, especially as it relates to professional education (Baskett, Marsick, & Cervero, 1992; Jarvis, 1992; Lovin, 1992).

In fact, there has been recent support for such experiential training as the basis for a renewed anaesthesia residency curriculum (Tweed & Donen, 1994).

The final theme encompasses the more practical aspects of the mechanics and mechanisms of the processes of the daily learning encounters between students and teachers of anaesthesia in the operating room. Other than that by Paget, Lambert, and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976), little has been described regarding such mechanisms or mechanics of teaching and learning. However, a generalized set of procedures that teachers repeatedly perform around the time of the learning encounter is suggested from the domain of school learning. From an educational standpoint, these activities may be divided into three phases: presage, process and product. Several authors have described the presage-process-product model (Biggs & Telfer, 1987; Dunkin & Biddle, 1974; Mitzel, 1960; see also Pratt, 1981; and Shulman, 1986). Presage refers to the events and conditions that precede the actual teaching and learning interaction between the student and the teacher; this interaction is defined as the process. Product refers to the outcome of the interaction in terms of educational attainment. A further delineation of the mechanics of presage, process, and product events or conditions of anaesthesia education in the operating room may help identify those which greatly impact in enhancing learning in this context.

Each of these four major themes will now be examined individually. A more detailed review will illustrate how each theme may relate to the teaching and learning processes for the anaesthesia resident in the operating room setting.

Theme 1. The Causal Influences on Student Classroom Learning

In order to examine the factors that may promote or hinder learning outcomes for anaesthesia education in the context of the operating room, one may gain useful information from those factors that appear to affect learning in other learning contexts.

Perhaps the most widely studied learning context is that of the classroom. Educational principles that apply to classroom learning for students from kindergarten to grade twelve have been defined (Cruickshank, 1990; Fraser et al., 1987a, 1987b; Porter & Brophy, 1988; Walberg, 1981, 1984, 1986; Wang et al., 1990, 1993, 1994; Waxman & Walberg, 1991; Wittrock, 1986). However, it is not known if these principles are applicable to the context of teaching and learning in the operating room with pupils in postgraduate medical education.

Several learning theories have been developed over the years and several authors have attempted to synthesize these theories into a single model. Haertel, Walberg, and Weinstein (1983) examined the theoretical learning theories of such educators as Carroll, Bloom, Glaser, and Bruner. The constructs that were found in common among most learning theories centered around four main factors that affect learning: student ability, student motivation, quality of instruction, and quantity of instruction. The social environment of the classroom, home environment, peer influence, and mass media were also stated to be minor influences. Haertel et al. (1983) summarized that

> classroom learning is a multiplicative, diminishing-returns function of four essential factors - student ability and motivation, and quality and quantity of instruction - and possibly four supplementary or supportive factors - the social psychological environment of the classroom, education-stimulating conditions in the home and peer group, and exposure to mass media. Each of the essential factors appears to be necessary but insufficient by itself for classroom learning; that is, all four of these factors appear required at least at minimum levels for classroom learning to take place. It also appears that the essential factors may substitute, compensate, or trade off for one another in diminishing rates of return; for example, immense quantities of time may be required for a moderate amount of learning to occur if motivation, ability, or quality of instruction is minimal. The roles of the other four factors are less clear. Although they prove to be consistent correlates of classroom learning outcomes, . . . they may supplement as well as support classroom learning. (pp. 75-76)

Walberg (1984) synthesized results of a number of investigations into education research to form a model of causal influences on student learning. He found that three main factors most greatly had an effect upon learning. These were factors relating to the student; the teacher; and the environment, including the home environment, the class environment, peers, and the influence of television (Figure 1). Although these factors have been shown to affect learning outcomes related to the classroom setting, similar studies have not been done to examine the factors that may affect learning on-the-job. However, useful information may be gained from these studies of classroom learning and may be extrapolated to the operating room setting. Thus, it is not known if these causal influences on student learning are applicable to the teaching and learning processes of anaesthesia residents in the context of the operating room. As well, it is not know if a certain number of these causal influences are of great importance in leading to better learning outcomes for this group of learners.

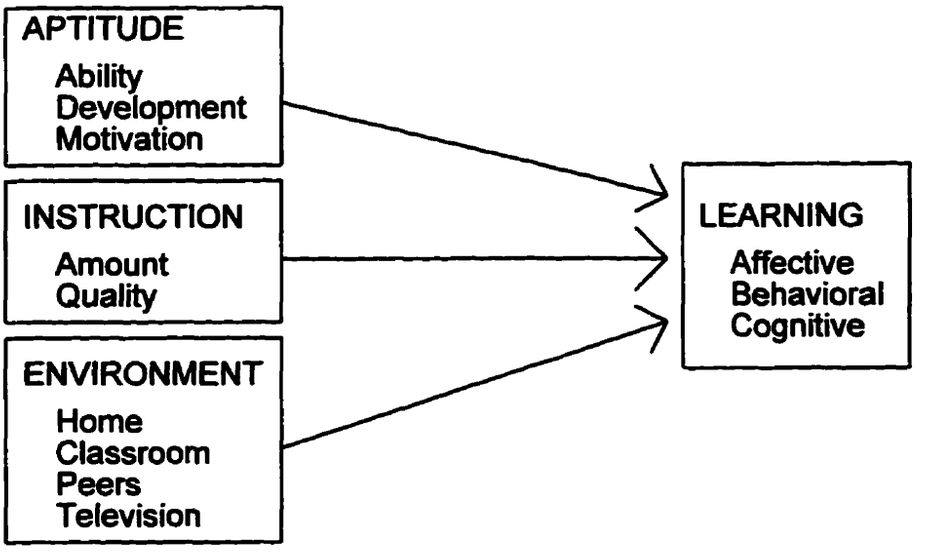


Figure 1

Factors That Affect Learning

Theme 2. Adult Learning Principles

Andragogy, or adult learning theory, maintains that adults learn in different ways than children (Brookfield, 1986; Cantor, 1992; Knowles, 1978, 1987; Merriam, 1993; Merriam & Caffarella, 1991; Pratt, 1993; Zemke & Zemke, 1988). This may have impact upon the teaching and learning processes of any educational system that is designed specifically for either pedagogical or andragogical learners. Since all learners of anaesthesia in the operating room are members of a postgraduate medical education programme, it appears that the principles of adult learning may be of importance.

Several collections of adult learning principles have been developed, but James (1983) developed a summary of principles from a search of articles, research reports, dissertations, and textbooks on adult learning. These principles of adult learning are presented in Table 1. As it may be seen, these principles do seem to relate to mature learners in professional medical education, such as anaesthesia residents. However, what is not known is whether these principles are being followed to an appropriate extent in current educational practice for anaesthesia residents learning in the operating room. Nor is it known if particular principles of adult learning are of extreme importance for anesthesia education in the operating room.

However, adult learners attempting to learn in new content areas may not entirely portray the characteristics of self-directed learners (Brookfield, 1992; Grow, 1991; Pratt, 1988; Shuell, 1990). Learners attempting to learn new items may require an approach that may more closely resemble a pedagogical method of learning. Such learners may simply prefer that the appropriate content is presented to them. This is in contrast to the adult learner who independently and actively pursues learning in a self-directed manner. Thus, the principles of adult learning may apply to senior anaesthesia residents, but may not be applicable to junior or novice residents, or those residents learning new items with which they have no prior conceptualizations.

Table 1

Principles of Adult Learning

1. Adults maintain the ability to learn.
2. Adults are a highly diversified group of individuals with widely differing preferences, needs, backgrounds, and skills.
3. Adults experience a gradual decline in physical / sensory capabilities.
4. Experience of the learner is a major resource in learning situations.
5. Self-concept moves from dependency to independency as individuals grow in responsibility, experience and confidence.
6. Adults tend to be life-centered in their orientation to learning.
7. Adults are motivated to learn by a variety of factors.
8. Active learner participation in the learning process contributes to learning.
9. A comfortable supportive environment is a key to successful learning.

Theme 3. Apprenticeship Training

Perhaps the greatest single identifying feature of anaesthesia education in the operating room that makes it unique is its special environmental learning context. One must not underestimate the impact of this harsh environment upon learning (Drui, Bhem, & Martin, 1973; Gaba & Lee, 1990; Gaba et al., 1991; McIntyre, 1982). In this on-the-job learning environment the anaesthesia resident must assess the patient; set up the operating room; induce, maintain, and discontinue anaesthesia while constantly monitoring the patient; and safely transfer the patient to the recovery room. This environment is busy and noisy with numerous distractions. The mind of the resident may not be focused continuously upon learning but does center around the job to be done. Patient safety is paramount and vigilance is a continual necessity.

A major distinction between teaching and learning in the operating room and other learning environments is that the operating room is not an environment primarily designed for learning, but rather for the purpose of performing operations. This environment is designed exclusively for the work to be completed, not for the purpose of education. Thus, not only does the anaesthesia resident take on the role of the student, but also that of the worker. As well, the staff anaesthetist takes on the role of the facilitator of learning and that of the supervisor, ensuring that the work gets done. The fact that the learner and facilitator take on these dual roles in this learning environment may have profound effect upon the teaching and learning processes that transpire therein. Obviously, learning the practice of anaesthesia in the operating room situation differs greatly from classroom learning. However, this context brings with it the advantages and limitations of on-the-job or apprenticeship training.

The definition of apprenticeship in the Living Webster Dictionary is "to put under the care of a skilled master for the purpose of learning a trade or profession" (Webster, 1971). This definition also describes the learning activities of the anaesthesia resident in

the operating room. Beverstock (1969) defined the purpose of apprenticeship training as being

> to train and educate an individual to become competent in one or more crafts, to develop his personality and to equip him with the necessary background of knowledge and attitude of mind which will enable him to play his part as an effective employee of his firm and as a useful citizen outside. (p. 296)

Beverstock went on to define the principles of apprenticeship training. These included fundamental principles such that (a) allied knowledge should be learned in addition to learning practical skills; (b) (skills) training and formal education should be integrated; and (c) the emphasis during apprenticeship should be on training rather than merely labor and production. The processes of apprenticeship training appear to closely represent those current educational processes of anaesthesia training in the operating room.

Advantages and disadvantages of apprenticeship training have been identified. Advantages include the fact that apprenticeship training allows for learning in the actual environment where future practice of the craft will occur (Beverstock; 1969; Burack & Smith; 1982; Collins et al., 1989; Farmer et al., 1992; Jarvis, 1989; Lovin, 1989; Simon et al.; 1991). This situated experience allows for integration of theory into practice (Al-Shehri, Stanley, & Thomas, 1993; Basse, 1969; Collins et al., 1989; Farmer et al., 1992), the integration of workshop skills into real-world skills (Collins et al., 1989; Moore, 1986), and for the learning of meaningful real-life tasks (Collins et al., 1989). Apprenticeship training allows for the practice of skills (Moore, 1986) which, when performed successfully, builds great self-confidence for the learner (Basse, 1969). Apprenticeship training usually occurs in the context of one-on-one instruction. This allows for individualized instruction (Blake & McPherson, 1973) with the teacher able to teach at the level of the student for as long a time as is necessary for completion of the learning task. Individualized instruction allows for active participation by the learner

(Bass & Vaughan, 1966; Moore, 1986; Simon et al., 1991) who may proceed at his or her own pace (Nickse, 1981) and allows immediate feedback from the teacher (Basse, 1969; Burack & Smith, 1982) who may also take on the important role of mentor (Blake & McPherson, 1973).

However, apprenticeship training has certain disadvantages. The primary function of the job is production, not teaching (Nickse, 1981). The worker may not be the ideal teacher (Beverstock, 1969). Teaching on-the-job creates extra waste and slows down production (Bass & Vaughan, 1966; Burack & Smith, 1982). Learning on-the-job introduces the student to the pressures of job demands, for example time constraints (Bass & Vaughan, 1966). Unfortunately, the particular job profile may dictate and limit the learner to only certain experiences available to be learned (Collins et al., 1989). The student also may become a source of cheap labor if supervisors forget the teaching and learning purposes of the apprenticeship program (Beverstock, 1969).

Recently, the concept of cognitive apprenticeship was described and the process of apprenticeships reviewed. Cognitive apprenticeship emphasizes two key areas beyond that of the apprenticeship model. As stated by Collins et al. (1989),

> first, . . . conceptual and factual knowledge are exemplified and situated in the contexts of their use, ... [thus] encouraging both a deeper understanding of the meaning of the concepts and facts themselves and a rich web of memorable associations between them and problem-solving contexts . . . . Second, . . . cognitive apprenticeship refers to the focus of the learning-through-guided-experience on cognitive and metacognitive, rather than physical, skills and processes. (p. 457)

The cognitive apprenticeship process (Collins et al., 1989; Farmer et al., 1992) includes the introduction of a new skill or craft to the student ("observation" and "modeling"), repeated practice of the skill or craft ("practice") with active feedback and assistance by the tutor ("coaching" and "scaffolding"), and finally gradual withdrawal of assistance by the tutor ("fading") to eventually yield independent practice of the skill or craft by the

student. This appears to closely resemble the current educational processes of anaesthesia training in the operating room. Roles of the student and teacher vary depending on the phase of learning in the Cognitive Apprenticeship Model as depicted in Table 2 (LeGrand Brandt et al., 1993).

Cognitive apprenticeship is related to the concepts of experiential learning (Al-Shehri et al., 1993; Kolb, 1984; Moore, 1981; Neighbor, 1992), situated cognition (Brown, Collins, & Duguid, 1989; Cognition and Technology Group at Vanderbilt, 1990; Resnick, 1987), and situated knowledge as described by Schon (1983, 1991). While the characteristics of cognitive apprenticeship have been applied for instruction in various topical areas, they have not yet been applied to the field of anaesthesia. Thus, it is not known if the principles of cognitive apprenticeship are applicable to anaesthesia education in the operating room and, if so, which factors or phases of cognitive apprenticeship are the most important in leading to successful learning outcomes.

Similar to the cognitive apprenticeship model is the concept of the student advancing through various phases of learning. Initially the student begins at the level of the novice and progresses to that of the expert practitioner. Dreyfus and Dreyfus (1986) have developed a model that describes such a progression of a student. While not being the only ones to outline distinct phases of learning (see Shuell, 1990), of interest is the fact that the Dreyfus model has been successfully applied to a study of nursing education by Benner (1982, 1984). A description of the stages is provided in Table 3. Again, such a description of the transition of the student from novice to expert does appear to resemble the stages through which an anaesthesia resident progresses during his or her residency programme. However, it is not known if such a model, in addition to the cognitive apprenticeship model, is entirely appropriate in describing the educational processes of anaesthesia education in the operating room.

Table 2

Phases of Learning in the Cognitive Apprenticeship Model

Phase	Role of the Teacher	Role of the Learner
Phase 1. Modeling	Model real-life activity that the learner wants to perform satisfactorily. Model states aloud the essence of the activity. He or she can include tricks of the trade.	Observe performance of total activity, not merely the individual steps. Develop a mental model of what the real thing looks like.
Phase 2. Approximating	Providing coaching to the learner. Provide support when needed.	Approximate doing the real thing and articulate its essence. Reflect on the teacher's performance. Use self-monitoring and self-correction.
Phase 3. Fading	Decrease coaching. Decrease providing support.	Continue to approximate the real thing. Operate in increasingly complex, risky, or ill-defined situations. Work individually or in groups.
Phase 4. Self-directed Learning	Provide assistance only when requested.	Practice doing the real thing alone. Do so within specified limits acceptable to profession and society.
Phase 5. Generalizing	Discuss the generalizability of what has been learned.	Discuss the generalizability of what has been learned.

Table 3

Stages of Learning from Novice to Expert

Stage	Definition or Description
Stage 1. Novice	One who has no experience of the situations in which they are expected to perform. Acquires new skills through instruction. Learns objective facts and acquires rules for determining actions based upon these facts. Learns situationally-independent (context-free) rules.
Stage 2. Advanced Beginner	One who can demonstrate marginally acceptable performance. One who has coped with enough real situations to note the recurring meaningful components of the situation.
Stage 3. Competent	One who has experienced a number of context-free and situationally-dependent cases in real-world circumstances. One who can develop a hierarchical procedure of decision-making by selecting from alternate plans, choosing the most important from a group, and then acting based on the overall goal.
Stage 4. Proficient	One who has the intuitive ability to perceive situations as a whole, rather than the component parts. Monitors the situation constantly and modifies plans based on prior knowledge of experiences encountered from the past. Thus, can anticipate outcome.
Stage 5. Expert	One who knows what to do based on mature and practiced understanding. One who has enough experience in a variety of situations and no longer relies on analytic principle to connect their understanding of the situation to an appropriate action.

Theme 4. The Mechanics of the Learning Encounter

The teaching and learning processes that occur during any given learning encounter are numerous if one is to consider the exact mechanics and mechanisms underway. Teaching is a complex activity. However, one may view these complex processes in terms of presage, process, and product events or circumstances (Biggs & Telfer, 1987). For classroom instructional decisions, Berliner (1982) has classified these into three main variables to consider: Preinstruction decisions, during instruction decisions, and postinstruction decisions. Definition of these variables is provided in Table 4.

A depiction of similar phases has been discussed by Arends (1993, see pp. 357-363). He reviewed teaching tasks in the preinstruction, during instruction, and postinstruction phases. Likewise, three stages of teaching have also been defined as preactive, interactive, and postactive stages by Clark and Peterson (1986, see p. 266).

Presage events or conditions refer to those that occur before the actual interaction between the student and the teacher (Biggs & Telfer, 1987). With respect to teaching practices, this also may be termed prior planning. Examples of presage activities from school practices include the teacher making a lesson plan or the student reading a textbook chapter for discussion in class the next day. Presage conditions may include the background and training of the teacher. Process activities are those that occur during the actual teaching procedure, such as the learning activities undertaken by the student. Process conditions may include the climate or atmosphere of the interaction, the motivation of the student and teacher during their interaction, and the degree of control over the interaction by the teacher. Product events may involve the activities of bringing closure to a learning encounter with a review of the session and constructive feedback provided to the students. This may also involve formative or summative evaluations.

Table 4

Presage, Process, Product Model of the Mechanics of Teaching

Phase and Variable	Definition or Description
Preinstruction (Presage)	
a) Choose content	Choosing which part of the curriculum to cover.
b) Pacing (content coverage)	How much to cover and over what period of time.
c) Allocating time	How much time students are to spend on each subject.
d) Activity structures	Choosing the method of instruction.
During instruction (Process)	
a) Engaged time	The actual time on task, rather than non-engaged time.
b) Success rate	Activities that are easy to master have high success rates for students.
c) Academic learning time	Time engaged with materials on activities related to the actual outcome measures that will be used.
d) Structuring	Time spent by a teacher giving directions.
e) Monitoring	Teacher checks students' progress.
f) Questioning	Used as an instructional technique.
g) Academic Orientation	Towards academic activities and goals, rather than informal activities such as play, games, etc.
Postinstruction (Product)	
a) Feedback	Corrective feedback, both positive and negative including assessment and the assigning of grades.

Product conditions may refer to whether these events are mandatory or elective, and whether they are imposed by the individual teacher or by the school board.

Little is known about the mechanics of the preinstruction, during instruction, and postinstruction events and conditions of anaesthesia education in the operating room. Further description is needed of the processes and mechanics of the learning encounter between the faculty (teacher) and resident (student) anaesthetist in their teaching and learning interaction in the operating room. Important presage, process, and product activities and conditions need to be delineated. Additionally, it is not known if specific mechanistic procedures of presage, process, or product greatly influence the eventual learning outcome of the learning encounter, whether it be success or lack thereof.

CHAPTER THREE: THEORY AND MODEL

The Underlying Thesis Theory and Model

The theory behind this thesis claims that certain things, or factors, are involved to combine to yield learning (Figure 2). This theory is context-free, in that no matter what one may wish to learn, and no matter where one may wish to learn, this theory holds true. A number of factors must come together to promote learning.

Figure 2

Thesis Theory

This underlying theory may be seen in each of the four themes presented earlier. The causal model for school learning (Walberg, 1984) identified nine factors that have been found to influence learning for students from kindergarten to grade twelve. The principles of adult learning (James, 1983) are the factors identified as promoting learning for adult learners. The principles of cognitive apprenticeship (LeGrand Brandt et al., 1993) are the processes by which learners in an apprenticeship programme will learn. The preinstruction, during instruction, and postinstruction events of learning (Berliner, 1982) are the factors of the mechanics of learning that promote profitable learning outcomes.

These, then, become part of the model of this thesis for identifying the factors that influence better learning outcomes for anaesthesia residents involved with teaching and learning in the operating room setting (Figure 3). In this specific context of learning, the model of this thesis is a combination of the four themes listed above. It is proposed that

anaesthesia education may need to consider some aggregation of the factors involved with (a) the causal influences on school learning, (b) adult learning principles, (c) cognitive apprenticeship methodology, and (d) the mechanics of learning. This aggregation of important factors will then lead to enhanced learning outcomes for learners of anaesthesia in the operating room context. The ultimate question is to determine exactly which factors, and which sub-component(s) of the factors, appear to be of greatest importance in promoting and ensuring enhanced learning outcomes for anaesthesia residents in the operating room setting.

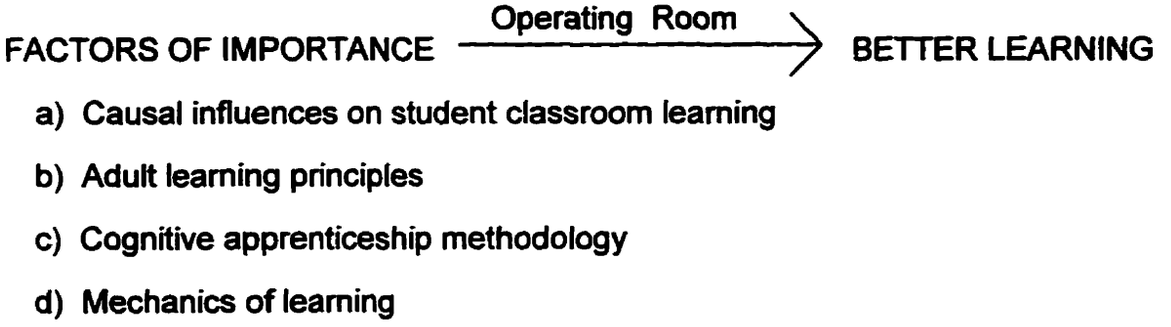


Figure 3

Thesis Model

Component Factors of the Educational Process

In order to systematically study the teaching and learning processes for anaesthesia residents in the operating room in terms of these four themes, one must first identify the major component factors of the educational process. Thus, this led to the creation of a comprehensive model of teaching and learning (Figure 4). This model was developed to ensure that all factors and components of the educational system (in the case

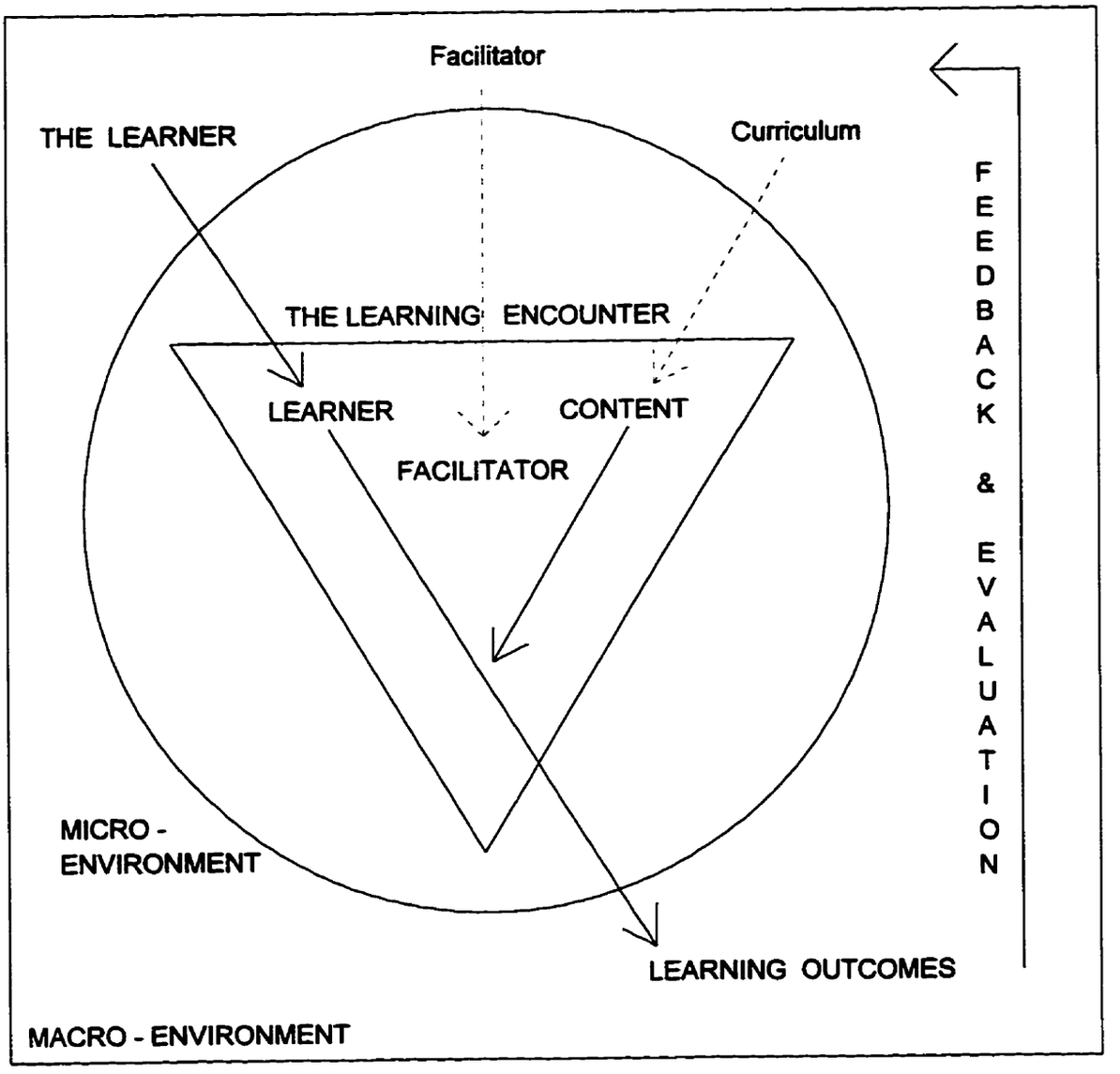


Figure 4

A Comprehensive Model of Teaching and Learning.

of this thesis, the educational system of anaesthesia education in the operating room) be included comprehensively to allow for the systematic study of each area. As well, it would ensure that no area would be inadvertently underemphasized or even disregarded completely. Corroboration for this comprehensive model of teaching and learning is verified from a literature review of over forty different teaching and learning models that have been presented in the past by various educational researchers (see Appendix A for references).

In this model of teaching and learning, the components involved are (a) the learner; (b) the content, in terms of the knowledge, skills, and attitudes to be learned by the learner; (c) the facilitator, someone or something that helps the learner master the content; (d) the learning encounter, the actual interaction between the learner, the content, and the facilitator; (e) the learning outcomes achieved by the learner, in terms of advancements in knowledge, skills, or attitudes; (f) the learning microenvironment, defined as the physical environment in which the learning encounter occurs; and (g) the macroenvironment of the learning institution, including the hierarchy and administrative policies of the learning institution.

Thus, the learner enters the learning encounter, at which time the learner is linked with the content to be learned with the help of a facilitator in order to accomplish learning outcomes. The microenvironment refers to the direct physical surroundings and situation of the learning encounter between the facilitator and the learner. For example, the micro-environment for school learning is the classroom. The operating room microenvironment for the anaesthesia resident has been noted to have numerous features that may impede teaching and learning processes (Drui et al., 1973; Gaba & Lee, 1990; Gaba et al., 1991; Hurst, 1992; Lambert & Paget, 1976; McIntyre, 1982; Paget & Eaton, 1977; Paget & Lambert, 1976). Such features impart restrictions upon the processes of the learning encounter, including teachable moments.

A major distinction between the teaching and learning for the anaesthesia resident in the operating room and that for teaching and learning in other environments is the fact that the operating room is not an environment primarily designed for learning, but rather for the purpose of performing operations. The anaesthesia resident is scheduled in the operating room to learn while doing work. Thus, the model of learning in the operating room is modified by the work factor.

This may be seen in Figure 5, where the learner takes the role of not only the student, but the worker as well. The fact that the learner takes on a dual role in this learning environment will have effect upon the teaching and learning processes therein. As well, not only is learning content to be mastered, but a job is to be done. The facilitator of learning is also the director of the work project. This facilitator not only helps the learner connect with the content to be learned, but also helps the worker connect with the job to be done. The processes undertaken by the learner-worker include not only those of the learning encounter, but also those of the working encounter. Outcomes include not only content to be learned, but also of a job to be completed. The classroom is also the job site and the job site is also the classroom. The administrative policies affecting this whole process include both those of the "school" and the "factory".

The macroenvironment refers to the hierarchy and administration governing the educational program, including the program's policies and aims. For example, for school learning, the learning macroenvironment encompasses the school principal, the school board, the school district, and the national governance. For anaesthesia training in the operating room, the administrative governance is directed by the Residency Training Programme that takes major directives from the Royal College of Physicians and Surgeons of Canada. These are examples of macroenvironmental factors that also affect the nature of anaesthesia education. Other macroenvironmental factors affecting the

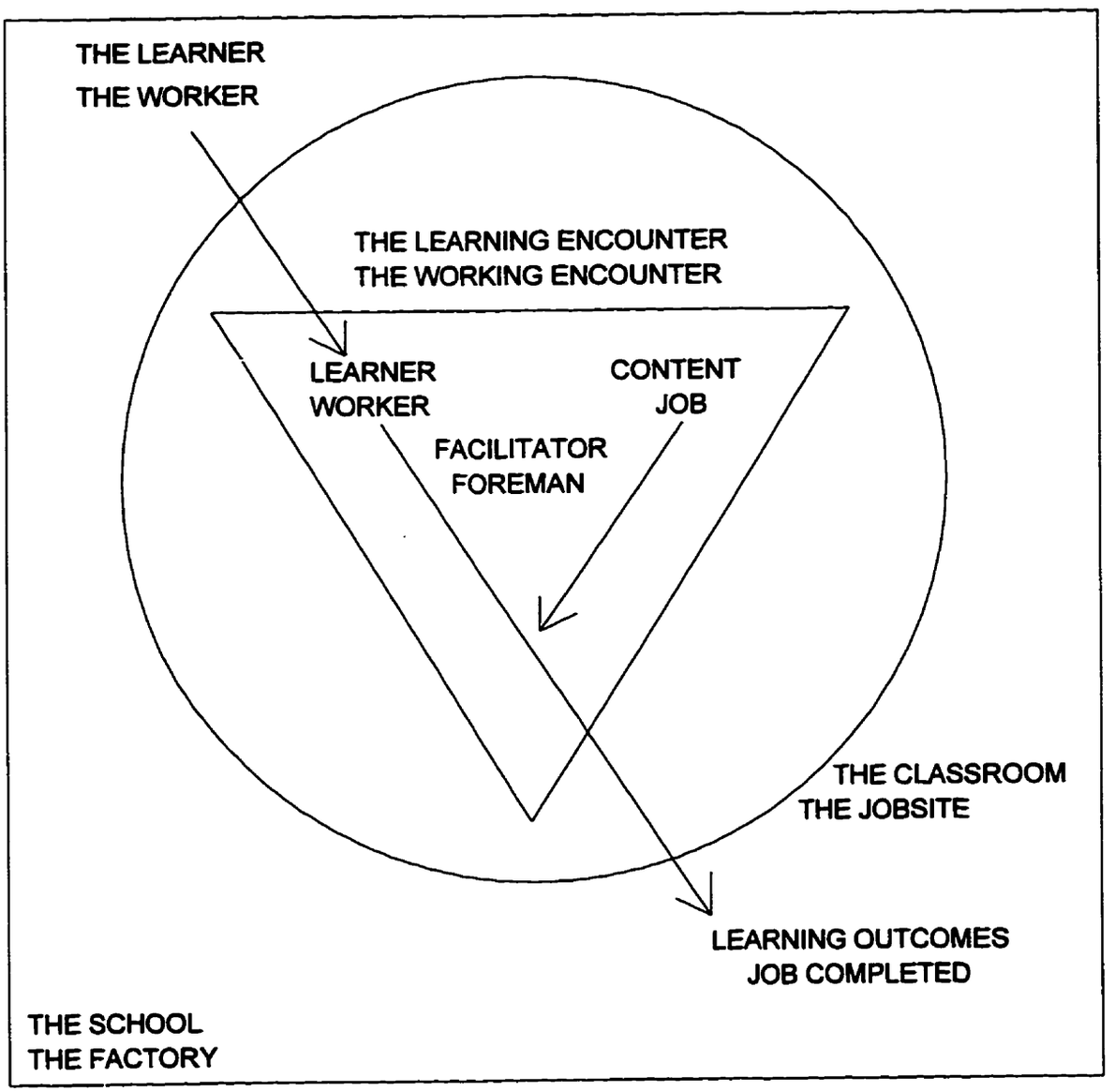


Figure 5

Apprenticeship Model of Learning in the Workplace.

teaching and learning situation are the influences of the home structure and societal pressures. As it may be seen the influence of both the micro- and macroenvironments may affect, in some way, the teaching and learning that occurs between the learner, the content, and the facilitator during the learning encounter.

Relation of Thesis Theory and Model to the Comprehensive Model

Illustration of how the comprehensive model of teaching and learning may assist in the systematic study of the teaching and learning of anaesthesia residents in the operating room is presented in Table 5. The various factors of the four themes of this thesis are all categorized to a particular component of the comprehensive model of teaching and learning. As it may be seen, this table provides a framework for the study of each individual element of anaesthesia education in the operating room. In a clear way, one may understand whether it is a factor of the student, the teacher, the learning encounter, the learning microenvironment, or the learning macroenvironment that is being addressed. This framework will ultimately assist in the eventual instrument (questionnaire) development in the methodology of this thesis.

The underlying theory of this thesis purports that various factors influence student learning. The application of this theory to anaesthesia education in the operating room develops into a model where the influences of four thematic areas upon the learning of the anaesthesia resident will be studied, including the causal influences on school learning, adult learning principles, cognitive apprenticeship methodology, and the mechanics of the learning encounter. Hopefully, information will be gained as to the important factors that most greatly influence anaesthesia education in the operating room. Efforts then may be taken to enhance and promote these important factors in order to ensure that profitable learning will occur.

Table 5

Correlation of Themes with the Comprehensive Model of Teaching and Learning

	Themes	
Comprehensive Model Component	Causal Influences on Student Learning	Principles of Adult Learning
Learner	Aptitude: ability, development, and motivation.	2. Diversified preferences, needs, backgrounds, skills. 7. Variety of motivating factors.
Facilitator	Instruction: amount, quality.	
Content		
Learning Encounter		4. Experiential learning. 5. Independency with growth. 6. Life-centered learning. 8. Active learner participation.
Learning Outcome		
Microenvironment	Environment: classroom.	9. Comfortable, supportive environment.
Macroenvironment	Environment: home, peers, television.	

(table continues)

Table 5 (continued)

Correlation of Themes with the Comprehensive Model of Teaching and Learning

	Themes	
Comprehensive Model Component	Cognitive Apprenticeship Methodology	Mechanics of Learning
Learner		Preinstruction, During instruction
Facilitator		Preinstruction, During instruction
Content		Preinstruction, During instruction
Learning Encounter	1. Modeling 2. Approximating 3. Fading 4. Self-directed learning 5. Generalizing	During instruction
Learning Outcome		Postinstruction
Microenvironment		Preinstruction, During instruction
Macroenvironment		Preinstruction, During instruction

CHAPTER FOUR: GOALS

Current Challenges to Anaesthesia Education in the Operating Room

Comprehensive knowledge regarding the current nature of anaesthesia education in the operating room is presently lacking. For the anaesthesia resident, the situational context of being taught and of learning in the operating room setting is definitely unique to this group of learners. Much is known about the process of learning in the classroom setting, small group setting, or bedside clinical teaching setting (Cox & Ewan, 1988; Hurst, 1992; Irby, 1978, 1992, 1994, 1995; McLeod & Hardin, 1985). However, other than the information presented by Paget, Lambert, and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976), unfortunately little is known about which proper topics and the methods by which to learn or teach these topics in the operating room setting. Nor is it known whether the principles and factors that affect learning may be directly extrapolated from these other settings and be applied to the operating room setting.

Teaching and learning in the operating room setting is important for the anaesthesia resident as it is in this unique setting where the anaesthesia resident has traditionally spent and continues to spend most of his or her time learning the requisite skills, attitudes, and knowledge necessary for attaining competency in the practice of anaesthesia. Yet, this learning environment has inherent physical restrictions and psychological drawbacks that may not make this environment conducive to learning (Cohen, 1980; Kam, Kam, & Thompson, 1994; Nahrwold, 1990). For example, the typical average noise level in an operating room is over 77 decibels (Murthy, Malhotra, Bala, & Raghunathan, 1995; see also Bruce & Bach, 1975; Bruce, Bach, & Arbit, 1974; Cottrell, 1981; Wilkinson, 1974). Workload and production pressures may be high (Berry & Hall, 1993; Gaba, Howard, & Jump, 1994; Gaba & Lee, 1990; Parsloe &

MacDonald, 1989). Additionally, fatigue and stress may limit the ability to attend to proper vigilance for the patient or to concentrate on a learning activity in this unique context (Cashman, Skelly, & Jones, 1989; Lichtor, Nuatto, Hendren, Lane, Dohrn, & Korttila, 1989; Loeb, 1994; McDonald, Spielman, Mayer, & Calhoun, 1994; Parker, 1987; Polk, Triplett, & Newman, 1988; Toung, Donham, & Rogers, 1985; Zelcer, Manton, & Paull, 1990).

Knowledge that the operating room setting is a harsh learning environment invites questions regarding necessary adaptations in teaching and learning techniques that are needed to compensate for this environment. At the present time, it is not known if operating room learning is optimal, both in terms of quality and quantity. Factors that promote or inhibit learning in the operating room have not been objectively identified.

Problem statement

Before attempting to propose a prospective study of any of the factors of importance regarding teaching and learning in the operating room for the anaesthesia resident, it would be helpful to identify first those factors, overall, that appear to influence the educational processes in this particular context. As well, it would be helpful to know which of these influential factors appear to most significantly impact upon these processes. Since these factors, overall, have yet to be defined, one must first determine the factors involved. Next, a ranking of the importance of the various factors would be in order.

One may only infer from a review of the literature the possible factors that may be involved, and then only attempt to guess at which factors may be of greatest influence to anaesthesia education in the operating room. However, those participants currently involved in the actual educational processes of teaching and learning in the operating room (both students and teachers) may be able to provide invaluable insight into (a) the

factors involved, and (b) the relative importance of these factors. As well, the involved participants may also be able to identify specific forces that may be working to promote or inhibit each of these influential factors. The involved participants have firsthand knowledge and experience into the intricate workings of the educational system in this particular context. While the involved participants may not have an advanced understanding of educational principles, they may be able to easily identify the factors of practical importance.

The involved participants may be able to identify and rank the importance of a variety of educational factors across the four major themes of this thesis, namely (a) the causal influences on school learning, (b) adult learning principles, (c) cognitive apprenticeship methodology, and (d) the mechanics of the learning encounter. Additionally, these involved participants may be able to verify and perhaps even advance upon the work previously done by Paget, Lambert, and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976).

As such, this thesis will examine the "beta press", or the interpretation of the environment as perceived by milieu inhabitants as compared to the "alpha press", or the actual conditions in the environment or its assessment by a detached observer through naturalistic or ethnographic studies (see Fraser, 1989, pp. 308-309 and Marjoribanks, 1994, p. 471).

CHAPTER FIVE: METHODS

In order to ascertain the opinions, values, preferences, attitudes and beliefs of faculty and resident anaesthetists regarding anaesthesia education in the operating room, survey research methods (Babbie, 1990; Borg & Gall, 1989; Fowler, 1993; Jaeger, 1988) using a standardized questionnaire instrument (Converse & Presser, 1986; Woodward, 1988) were utilized. Approval for research on human subjects was obtained from the Centre for Advancement for Health at Foothills Hospital and the Conjoint Medical Ethics Committee at The University of Calgary. Written informed consent was obtained from the respondents to the questionnaire. The survey was done in two parts.

Survey: Part 1 (The Q1 Questionnaire)

The initial survey was a 28-page, 210 item, standardized questionnaire (see Appendix B) with parallel forms for faculty and resident anaesthetists. This was a self-developed questionnaire with individual questions composed based on the literature review of the four thematic areas of interest in this thesis. The questions regarding the mechanics of teaching and learning in the operating room were developed from the author's personal experiences of both teaching and learning in such a setting.

The initial question posed to respondents asked them, in an open-ended manner, to rank the top three important educational factors that they felt most greatly affected teaching and learning processes in the operating room setting between an anaesthesia resident and a staff anaesthetist. This question was designed to have respondents reflect on important educational factors without any prompts from closed-ended questions. In this way, their independent and unbiased opinions could be captured. Following this, a series of open- and closed-ended questions guided the respondents through a series of probes related to the four thematic areas of interest. Table 6 correlates the question

Table 6

Correlation of Questionnaire Items to the Thematic Area of Interest

Thematic Area		Q1 Questionnaire	Q2 Questionnaire
I. School Learning			
Student aptitude	Ability	2	4a
	Development	1a-b	4b
	Motivation	3	4c
Instruction	Amount	10, 45, 46, 47	4d (25)
	Quality	7, 8, 11, 12	4e (26)
Environment	Home	62b	4h
	Classroom	26, 37c-d, 38, 49, 53, 55, 61, 62a	4f
	Mass media (TV)	--	4g
II. Principles of Adult Learning			
Differing needs		4a-b, 23, 26, 32, 53	5a, 10, 11
Experiential learning		31, 37a-b	5b, 15, 16, 24, 31, 32
Dependency to independency		22, 28, 55	5c, 31, 32
Life-centered orientation		36e-h, 37a-b	5d, 31, 32
Motivation		3	5e
Active participation		22, 24, 25, 28, 37a-b	5f, 18
Comfortable learning environment		26, 37c-d, 38, 49, 53, 55, 61, 62a	5g, 17, 24, 32

(table continues)

Table 6 (continued)

Correlation of Questionnaire Items to the Thematic Area of Interest

Thematic Area		Q1 Questionnaire	Q2 Questionnaire
III. Apprenticeship Models			
Cognitive apprenticeship		35, 36a-c	33
Novice to expert		36d	--
IV. Mechanics of Learning			
Presage	Choose content	16, 17, 18, 29, 33, 36e-h	6-15
	Pacing	30, 51, 57, 58, 60	15
	Allocating time	29, 32, 41-47, 57, 58, 60	25
	Activity structures	19, 20, 31	--
	Other	9b	34
Process	Engaged time	32, 45-47	27-29
	Academic learning time	32	--
	Monitoring	27	--
	Questioning	22	18
	Academic orientation	32	--
Product	Feedback	34	36, 37
V. Confirmation of the studies done by Lambert, Paget, & Eaton on the mechanics of learning		39-47	18, 20-23, 27-29

number on the Q1 questionnaire to the corresponding thematic area of interest.

Questions were grouped according to the major factors in the Comprehensive Model of Teaching and Learning (Figure 4): the student, the teacher, the learning encounter, the learning microenvironment, and the macroenvironment of the programme. Paired closed-ended questions were posed on a particular topic to identify the impact, (a) currently and (b) ideally, that that particular topic has upon teaching and learning in the operating room. A 4-point Likert-like scale was used repeatedly for these closed-ended questions using frequency scale adjectives: *never*, *sometimes*, *usually*, *always* (Gable, 1986). Frequent follow-up, open-ended questions were asked among the closed-ended questions to allow respondents to identify and express, in their own words, any factors that promote or interfere with the ideal situation. Thus, the current and ideal nature of anaesthesia education in the operating room could be determined as well as any factors that promote or interfere with the current nature being ideal (Figure 6).

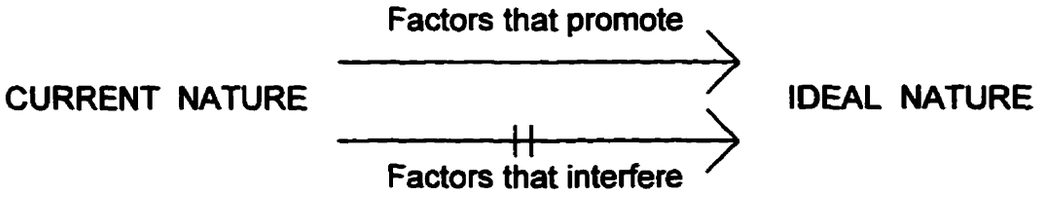


Figure 6. Question Structure for the Questionnaire

Once respondents had been directed through questions on each of the four thematic areas, a final question again posed the initial task of ranking the top three most important educational factors impacting upon teaching and learning in the operating room. This initial Q1 questionnaire was lengthy in order to probe, in detail, a variety of areas of possible significant influence on teaching and learning in the operating room.

Completion of the Q1 was asked of ten faculty anaesthetists (Foothills Hospital site only) and ten resident anaesthetists. Residents were selected from all five of the Post-Graduate Years (PGY) of training: one PGY-1, one PGY-2, two PGY-3, one PGY-4, and five PGY-5 residents. These were respondents who showed an interest in anaesthesia education or those who the author could depend upon their completing the long Q1 questionnaire. Thus, this initial questionnaire surveyed 19.6% of faculty and 52.6% of resident anaesthetist eventually to be included in the entire sampling of respondents. Respondents to the Q1 questionnaire were allowed sufficient time to complete this lengthy, in-depth survey. Questionnaires were completed over approximately a twelve month period from April, 1995 to March, 1996.

In addition to its use as a pilot study for individual questions, this initial questionnaire was used as a written focus group to determine the factors that appeared most important to further investigate in the subsequent target population. This initial focus group was done by the written questionnaire format (as opposed to the usual oral focus group) as logistics would have made it difficult to get this group of physicians, all in busy clinical practice with varying time schedules, together in one place and time to discuss such a wide range of educational issues. As well this written questionnaire allowed respondents to individually and independently respond to items. They were allowed to reflect upon their responses to all questions over whatever length of time they deemed necessary. Thus, it was hoped that valuable independent assessments would be obtained. By keeping the individual opinions from the focus group independent allowed for repeat sampling of these initial respondents to the subsequent Q2 questionnaire as a check for reliability and stability of responses over time.

Responses from the Q1 written focus group were then analyzed. Individual questions were identified where responses indicated a high degree of importance of the item (an item average greater than 3 on the 4-point scale) to teaching and learning in the

operating room. This was done for all questions overall, as well as for those questions grouped according to the four thematic areas of interest. Analysis of the responses from the first and last Q1 items, where respondents were asked to rank factors of importance in an open-ended fashion, also allowed for the categorization of responses into 22 separate categories. These categories then were used for the Q2 questionnaire construction and analysis coding procedures (see later).

The analysis of this pilot study prompted several changes in the questionnaires for the final Q2 version of the thesis survey. Technical aspects of some of the Q1 items were identified. Some respondents challenged the response choices of *never* and *always*, citing difficulty in responding in such a way to any question in medicine. As well, several respondents indicated their response half-way between two response choices for several questions. Thus, the response scale was changed from a 4-point scale to a 5-point scale with an undecided (*don't know*) response (Gable, 1986). This allowed respondents a middle response alternative as well as the choice of an undecided response, despite controversy regarding these issues (Bishop, 1987; Converse & Presser, 1986; Gilljam & Granberg, 1993). As well, a closer and more direct correlation was made between the principles of each thematic area and the questions posed, especially for the thematic areas of causal influences of school learning and principles of adult learning. Furthermore, a consistent scaling was used throughout the Q2 questionnaire to ensure that not only the most important item in each thematic area be identified, but also a relative ranking of items across thematic areas be established.

Thus, the Q1 written focus group pilot study was used to design a questionnaire that was shorter, easier, and less time-consuming to complete; one that could be widely distributed to the entire target population. The Q1 pilot questionnaire process attempted to ensure that only the most important questions, and not trivial ones, be asked subsequently and that most technical problems of the items be corrected.

Survey: Part 2 (The Q2 Questionnaire)

The final survey was a 14-page, 137 item, standardized questionnaire (see Appendix C) with parallel forms for faculty and resident anaesthetists. Again, this was a self-developed questionnaire based upon the literature review and the responses obtained from the Q1 questionnaire. Unfortunately, the Q2 remained a long survey in order to elicit responses to a variety of important and complex educational factors. This was not surprising as this matches the results of Wang et al. (1994) where 28 main factors were found to influence teaching and learning in school settings from kindergarten to grade twelve, and that not a few main factors were entirely responsible for assuring profitable learning outcomes for students.

As similar to the Q1 questionnaire, the Q2 questionnaire initially asked respondents to rank, in an open-ended fashion, the top three important educational factors that they felt most greatly affected teaching and learning processes in the operating room between an anaesthesia resident and a staff anaesthetist. Subsequent questions again guided respondents through a series of items regarding each of the four thematic areas. Table 6 correlates the question numbers on the Q2 questionnaire to the corresponding thematic area of interest. Certain questions were imported verbatim from the Q1 questionnaire. A total of 43 question stems from the Q1 were repeated in an identical format on the Q2. As well, questions were refined to more closely correlate to the principles outlined in each thematic area.

Since the Q2 questionnaire remained long, mainly closed-ended questions were posed to facilitate its completion by a large audience. Paired closed-ended questions were posed on a variety of educational methods. For a particular educational method, respondents were asked to identify (a) the current frequency of practice of that method and (b) the importance that the respondent felt should be placed on the practice of that particular method. In this way, analysis could be done to see how frequently the

important educational methods are being practiced at the current time. If respondents felt that a particular educational method or factor was very important but was currently not being practiced frequently, this would be an area identified as requiring modification in the residency programme. As well, the importance of various educational methods and factors across the questionnaire could be compared in order to identify those of greatest importance across all thematic areas.

Likert-like frequency and importance scales were utilized for these closed-ended questions (Gable, 1986). The frequency scale was a 5-point scale with an undecided response: *almost never, infrequently, occasionally, frequently, almost always, don't know.* The importance scale was a 5-point scale with an undecided response: *unimportant, of little importance, moderately important, important, very important, don't know.*

Once respondents had been directed through questions on each of the four thematic areas, a final question (question 38) asked them to rank the top five factors of importance to the educational processes in the operating room from a list of 28 options. The list of 28 options was developed from the 22 categories generated in the initial and final questions on the Q1 questionnaire. These 22 factors then were grouped according to the six major factors in the Comprehensive Model of Teaching and Learning (Figure 4) to allow analysis of data with respect to the categories of the student, the teacher, the student-teacher interaction, the microenvironment, and the macroenvironment. In each of these six groups, an "other" category was provided to allow respondents to fill in their own factor, in case the list of 22 factors was not felt to be sufficiently comprehensive.

Once respondents had identified what they felt were the five overall important factors for anaesthesia residency training, they were asked to determine if the current practice in the Calgary training programme was meeting the ideal. This was done by means of the 5-point Likert scale of agreement: *strongly disagree, disagree, neutral,*

agree, strongly agree. To complete the task as outlined in Figure 6, respondents were finally asked, in an open-ended fashion, to identify factors in the Calgary training programme that may be inhibiting each of the five overall important factors they had previously identified of the anaesthesia programme and other general factors. A closing set of open-ended questions did remain to ensure that respondents again had ample opportunity for expressing their own opinions in their own words and to identify or emphasize factors that they felt were important, even if such factors had not been previously identified or noted.

The Q2 questionnaire was distributed to all University of Calgary faculty and resident anaesthetists with clinical teaching and learning assignments in the operating room. This included faculty at the Foothills Hospital (FHH) site (n = 25), the Bow Valley Centre and Peter Lougheed Centre (BVC/PLC) sites (n = 16), and the Alberta Children's Hospital (ACH) site (n = 8), and residents in the anaesthesia residency training programme (n = 19). Exclusion criteria were those faculty anaesthetists with one day per week or less of clinical anaesthesia activity in the operating room at one of the affiliated hospitals. This exclusion was made since such individuals would have minimal exposure to the direct educational processes of anaesthesia residents in the operating room setting.

All questionnaires to be distributed included a covering letter and two copies of a written, informed consent, one of which the participant could retain for his or her own records. Initial distribution to faculty was done in person at departmental rounds (FHH 17/25 = 68.0%, BVC/PLC 11/16 = 68.8%, ACH 6/8 = 75.0%) with the remaining distributed through an initial mailing. Follow-up distribution of the questionnaire to initial faculty non-responders was done by a single second-mailing of the questionnaire with a different covering letter (Dillman, 1978). All questionnaires distributed by mail included a self-return envelope to the author that could be used within the interhospital mail system. Distribution to all resident members was done in person at a regularly

scheduled core program lecture for the residents ($n = 9$). Both faculty and residents who had completed the Q1 questionnaire were also asked to complete the Q2 questionnaire. This was done as a reliability and validity check of their responses over time.

Demographical data collected entirely at the option of the respondent included, for faculty, the number of years teaching anaesthesia residents, and for residents, their postgraduate year (PGY) of training. Respondents were asked their name to allow the possibility of a follow-up personal interview to grant opportunity for clarification of any responses, if necessary. Again, a long amount of time to complete the questionnaire was granted. Questionnaires were completed over a 2 month period from mid-June to mid-August, 1996.

Methods of Analysis

Responses from both the Q1 and the Q2 surveys were coded and analyzed on the computer software program, the Statistical Package for the Social Sciences (SPSS® for Windows 6.0™, SPSS Inc., Chicago, IL, 1993). Descriptive statistics were derived from the database. Analysis was done separately by faculty and resident groups, except where specified.

Ideally, median values are used to describe the central tendency for ordinal data. However, to provide more detailed comparative descriptive statistics for the central tendency of faculty and resident responses to the ordinal Likert-like scales, a "mean" value was calculated by assuming an interval scale for responses. This was done by coding the data as, for example: *unimportant* = 1, *of little importance* = 2, *moderately important* = 3, *important* = 4, and *very important* = 5. Thus, the "mean" response to this scale would be the arithmetic mean value, out of a possible maximum of five. The response *don't know* was not coded and left blank in the database.

However, when comparing the statistical significance of the differences between the two independent groups of faculty and resident ordinal responses, the nonparametric Wilcoxon-Mann-Whitney test was used (Siegel & Castellan, 1988). This test does not convert the ordinal responses into an interval scale and assumes only the ordinal nature of the data. It is based on the rank order of responses. The Mann-Whitney U is the nonparametric equivalent of the parametric Student's t-test for comparing means between groups. Parametric statistical methodology was not used as one could not assume equal intervals between the anchors on the ordinal scales, nor a normal distribution with equal variances for each group of responses compared.

Comparison of nominal (categorical) data between respondents, or groups of respondents, was analyzed using the Pearson chi-squared (χ^2) test (Siegel & Castellan, 1988). The chi-squared analysis of data from several categories between faculty and resident respondent groups resulted in statistically significant differences being observed. However, such a global analysis did not identify the specific categories that were responsible for the overall significant differences. Thus, in such cases, the procedure of partitioning the overall chi-squared contingency table was done to identify those specific categories that were responsible for the overall statistically significant differences observed between the two groups (see Siegel & Castellan, 1988, pp. 118-123).

To assess the measurement of association or degree of agreement of respondents, or groups of respondents, across a number of questions, the Kendall coefficient of concordance (W) was calculated. As described by Siegel and Castellan (1988), "W expresses the degree of association among . . . variables, that is, the association between k sets of rankings. Such a measure may be particularly useful in studies of interjudge or intertest reliability" (p. 262). Kendall's W is calculated based on the rankings given to each variable by each judge. Thus, it is a nonparametric test and assumes that the data are of an ordinal, and not interval, nature. The interpretation of Kendall's W, as stated by

Siegel and Castellan (1988), is such that "a high or significant value of W may be interpreted as meaning that the k observers or judges are applying essentially the same standard in ranking the N objects under study" (p. 271). In this study, the Kendall W was also used for the analysis of interform reliability estimates between the Q1 and Q2 questionnaires. For the analysis of intraform reliability estimates for the two repeated questions within the Q2 questionnaire, the nonparametric Spearman rank correlation coefficient was calculated (Siegel & Castellan, 1988).

In all cases, the level of significance was set at $p<0.05$, including the comparison of nominal and categorical data between groups, as well as for Kendall's W measure of association and for the Spearman correlational coefficient.

CHAPTER SIX: RESULTS

Response Rate and Demographics

Overall response rate to either the Q1 or Q2 questionnaire was 49/68 = 72.1%. Ten faculty at the FHH (out of a possible 25 = 40.0%) and ten residents (out of a possible 19 = 52.6%) completed the Q1 questionnaire. Not all faculty at FHH nor all residents were asked to complete the Q1 questionnaire. Faculty response rate to the Q2 questionnaire was 33/49 = 67.4%. The response rate by hospital site was: ACH 6/8 = 75.0%, BVC/PLC 11/16 = 68.8%, FHH 16/25 = 64.0%. Eight faculty completed both Q1 and Q2 questionnaires, representing 16.3% of faculty that responded. Resident response rate to the Q2 questionnaire was 8/19 = 42.1%. Four residents completed both the Q1 and Q2 questionnaires, representing 21.1% of residents that responded. Two faculty and six residents only completed the Q1 questionnaire but not the Q2 questionnaire. However, to allow for the presentation of the widest sampling of respondents' opinions, their responses to the 43 questions that were identical on both the Q1 and Q2 questionnaires were included in the analysis of the data. This inclusion of Q1 responses with the Q2 data was deemed appropriate because of the high level of interform reliability (see Reliability section later). Even so, results were essentially the same if analyzed using only responses to the Q2 questionnaire and excluding Q1 questionnaire responses.

Demographic data revealed that the mean number of years of teaching by the faculty respondents was 8.7 (standard deviation 5.4) years, with a range of 1-25 years. Distribution by year of residency training for resident respondents was: PGY-1 three (of three), PGY-2 two (of two), PGY-3 two (of four), PGY-4 two (of three), and PGY-5 five (of seven). There were no statistically significant differences between respondents and nonrespondents for faculty, in terms of distribution by gender or hospital site of practice, and for residents, in terms of distribution by gender or year of residency training.

Overview of Data Presentation

Initially, analysis is made in each thematic area to determine which items were stated to be of greatest importance by respondents. Then, analysis is made across all thematic areas to determine those items that were deemed most important. Following this, analysis is made of the responses to the ranking of the factors that respondents felt to be of greatest overall importance to teaching and learning in the operating room. Then, analysis is made of those factors ranked as the most important factors to see how closely The University of Calgary residency programme meets the respondents' perceived ideal. Factors inhibiting the current practice from being ideal are explored for each of these important factors. Subsequently, the items for the Theme 4 mechanics of teaching section are analyzed looking again at the differences between the current practice and the ideal. In addition, data are presented for those items that attempt to corroborate the prior work of Paget, Lambert and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976). Finally, the reliability of respondent's responses is presented.

For those items identical on both Q1 and Q2 forms of the questionnaire, analysis includes responses to both questionnaires. The process of linear transformation (see Allen & Yen, 1979, p. 149) was done to convert the Q1 questionnaire responses from a 2-point ordinal scale, a 4-point ordinal scale, an 11-point ordinal scale, and a 0-100 linear scale all into a 5-point ordinal scale which was used repeatedly in the Q2 questionnaire. The procedures and their transformation equivalents are presented in Appendix D.

Theme 1. The Causal Influences on Student Classroom Learning

The distribution of the mean scores for Theme 1 questions for both faculty and resident respondents is shown in Figure 7. Analysis of faculty responses over the eight Theme 1 questions (questions 4a-h) revealed a Kendall W coefficient of concordance of 0.43, and this reached statistical significance ($p<0.0001$). Similar analysis of resident

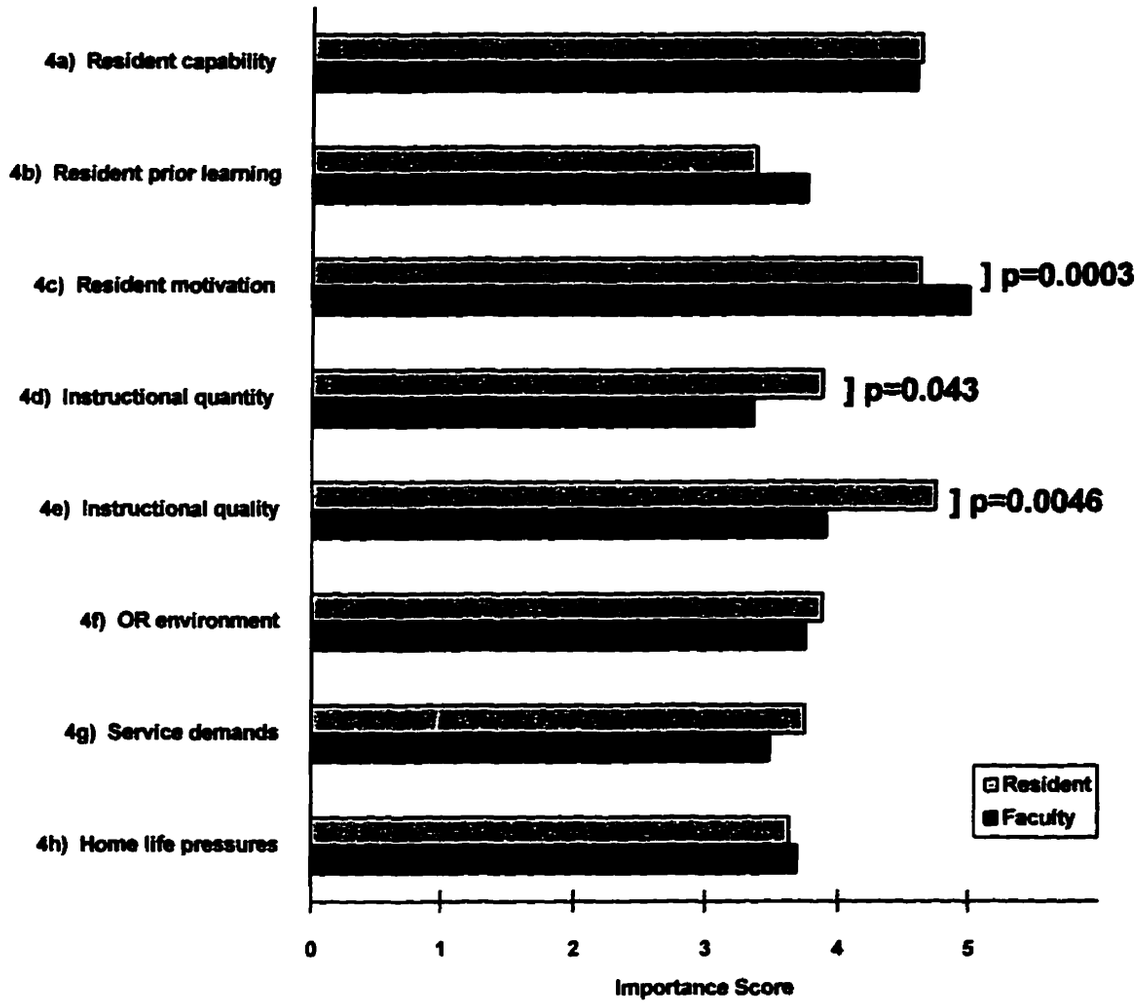


Figure 7

Mean Scores for Theme 1 Questions

Analyzed by Resident and Faculty Respondent Groups

responses yielded a Kendall coefficient of concordance of 0.42, and this also reached statistical significance (p=0.0013). Thus, all faculty and residents within their respective groups responded in a similar fashion to all Theme 1 questions, and this was unlikely due to chance.

Overall, of the factors regarding the causal influences on student classroom learning as they relate to anaesthesia education in the operating room, faculty felt that the most important factors were resident motivation (mean score 5.00 on the 5-point scale) and resident capability (mean score 4.59). In contrast, residents felt that the most important factors were instructional quality (4.75), resident capability (4.63), and resident motivation (4.62). Significant differences between faculty and residents were found on three questions. Faculty, more than residents, felt that resident motivation was a more important influence on student learning outcomes (Mann-Whitney U, p=0.0003). Residents, more than faculty, felt that instructional amount and quality were more important influences on student learning outcomes (Mann-Whitney U, p=0.043 and p=0.0046, respectively). All Theme 1 questions received a mean score greater than 3 on the 5-point scale (i.e., more than *moderately important*) in both the faculty and resident groups.

However, despite these differences in rankings among the eight items between faculty and resident groups, both groups ranked the eight items in a similar order of importance. The Kendall W coefficient of concordance of the faculty and resident groups' rankings of Theme 1 questions was 0.77. However, this value did not reach statistical significance (p=0.15). Thus, this concordance could just be due to a chance observation.

Theme 2. Adult Learning Principles

The distribution of the mean scores for Theme 2 questions for both faculty and resident respondents is shown in Figure 8. Analysis of faculty responses over the seven

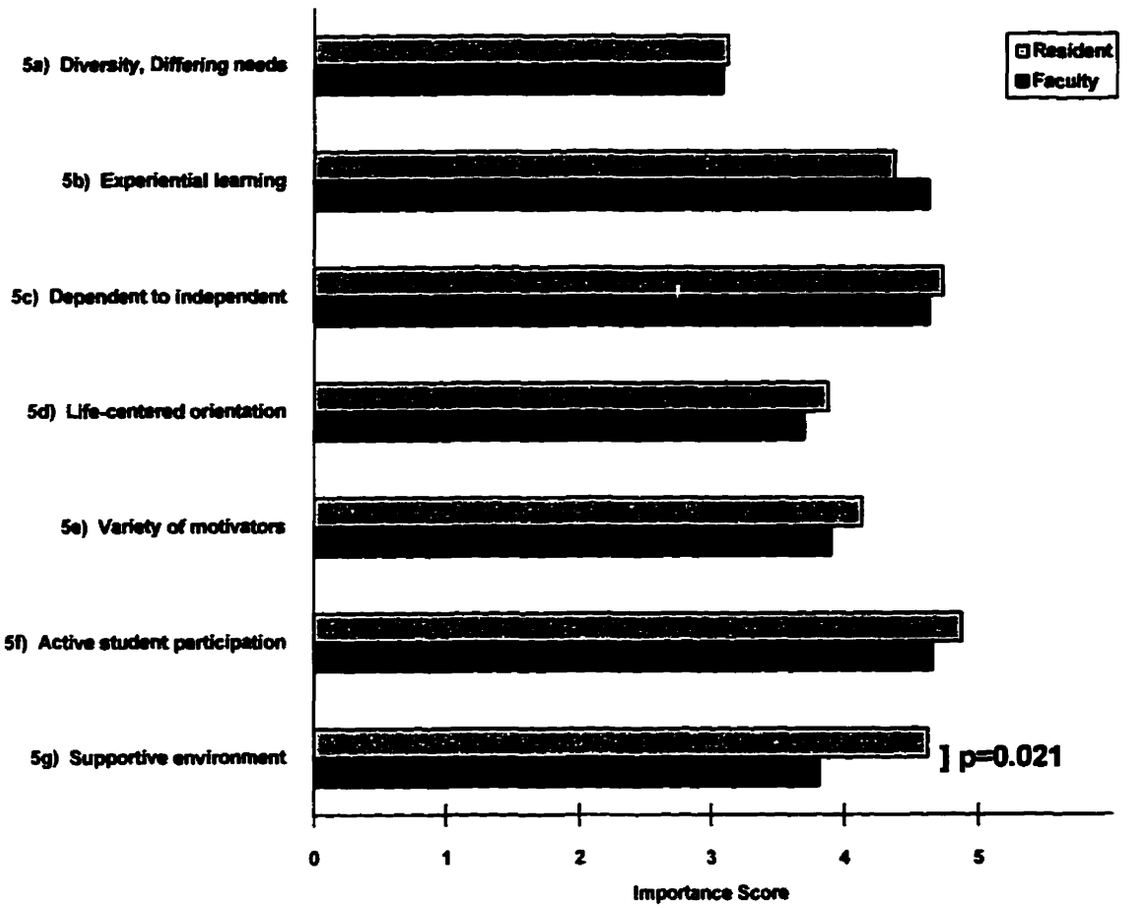


Figure 8

Mean Scores for Theme 2 Questions

Analyzed by Resident and Faculty Respondent Groups

Theme 2 questions (questions 5a-g) revealed a Kendall coefficient of concordance of 0.43, and this reached statistical significance ($p<0.0001$). Similar analysis of resident responses yielded a Kendall coefficient of concordance of 0.43, and this also reached statistical significance ($p=0.0021$). Thus, all faculty and residents within their respective groups responded in a similar fashion to all Theme 2 questions, and this was unlikely due to chance.

Overall, of the factors regarding the principles of adult learning as they relate to anaesthesia education in the operating room, both faculty and residents felt that the most important factors were active resident participation (faculty mean 4.67, resident mean 4.88) and the concept of increased independency of the resident as they learn and grow (faculty 4.64, residents 4.75). The faculty also rated experiential learning (4.64) highly. The residents, more than faculty, felt that a comfortable and supportive learning environment is a key to successful learning for the resident (Mann-Whitney U, $p=0.021$). Again, all Theme 2 questions received a mean score greater than 3 on the 5-point scale in both the faculty and resident groups.

However, despite these differences in rankings among the eight items between faculty and resident groups, both groups ranked the eight items in a similar order of importance. The Kendall W coefficient of concordance of the faculty and resident groups' rankings of Theme 2 questions was 0.93. However, this value did not reach statistical significance ($p=0.08$). Thus, this concordance could just be due to a chance observation.

Theme 1 and 2 coefficients of concordance for the overall faculty and resident rankings across questions probably did not reach statistical significance because the power efficiency of the Kendall W is low when such a small sample size of questions is analyzed. The power of the Kendall W is approximately 0.80 when the sample size is equal to five. In these instances, sample sizes were eight and seven, respectively, for Theme 1 and Theme 2 questions.

Theme 3. Cognitive Apprenticeship Methodology

Both faculty and residents found the cognitive apprenticeship model to be *moderately important* to *important* as a description of a model of teaching and learning for anaesthesia residents in the operating room. For the Q2 survey, there were no significant differences between mean faculty (3.66) and resident (4.02) responses. This was similar to the Q1 questionnaire results.

An in-depth examination of this model was not undertaken on the Q2 questionnaire as the Q1 questionnaire did not reveal strong opinions (mean scores were less than 3 on the 4-point scale) as to the overall importance of this factor in relation to the other factors analyzed. Responses on the Q1 questionnaire (questions 36 a-c) revealed that faculty and resident respondents generally found value in the cognitive apprenticeship model. However, they identified that modeling, specifically the teacher stating aloud the essence of the activity, and generalizing are the items that currently are not being done, but should be done, in The University of Calgary training programme.

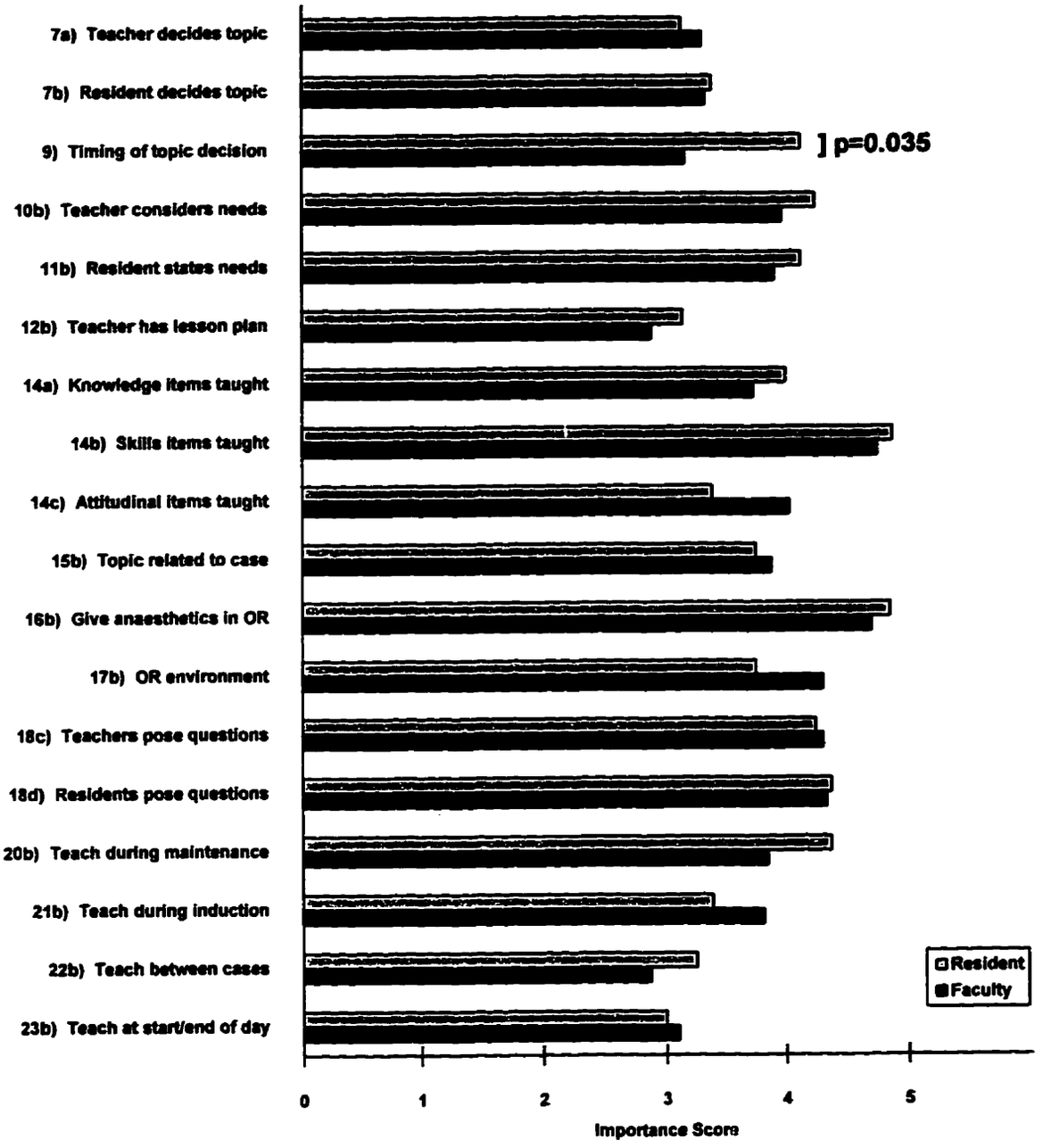
Factors identified as interfering with proper modeling included teachers not having or taking the time to articulate their thought processes, teachers assuming that the student already knows the essence of the activity, and teachers jumping to later phases too quickly with students. In defense, teachers stated that they normally function without articulating aloud, thus making it difficult to do so when students are present as well as the difficulty in knowing the stage at which the resident is currently performing. Factors stated as interfering with the generalization phase included the fact that attention is usually directed to something else before the generalization is discussed. As well, it was identified that it is difficult to articulate the big picture to a beginner since all concepts are second-nature to the teacher (expert). Residents also identified more frequently than faculty the importance of teachers only providing assistance when requested.

Thus, respondents were under the opinion that the cognitive apprenticeship model is moderately important to anaesthesia education in the operating room. Cognitive apprenticeship methodology that respondents felt needed to be emphasized included teachers stating aloud their rationale for their actions, teachers only providing assistance to students when asked, and discussing the generalizability of a topic before moving on to another activity.

Theme 4. The Mechanics of the Learning Encounter

The distribution of the mean scores for Theme 4 questions for both faculty and resident respondents is shown in Figure 9. Analysis of faculty responses over the 35 Theme 4 questions (all other Q2 questionnaire questions in which respondents answered to the 5-point "importance" scale) revealed a Kendall coefficient of concordance of 0.33, and this reached statistical significance ($p<0.0001$). Similar analysis of resident responses yielded a Kendall coefficient of concordance of 0.60, and this also reached statistical significance ($p=0.0028$). Thus, all faculty and residents within their respective groups responded in a similar fashion to all Theme 4 questions, and this was unlikely due to chance. There were no statistically significant differences between faculty and resident groups, except that residents placed a greater importance than faculty on the proper timing for deciding the topic for the next day's learning encounter (question 9, Mann-Whitney U, $p=0.035$).

Overall, of the factors regarding the mechanics of the learning encounter for anaesthesia education in the operating room, both faculty and residents ranked three factors as the most important. Both groups felt that it was most important that skills items be taught in the operating room setting (question 14b, faculty mean 4.76, resident mean 4.88). Next most important was the importance for residents in learning how to



(Figure 9 continues)

Figure 9

Mean Scores for Theme 4 "Importance" Questions

Analyzed by Resident and Faculty Respondent Groups

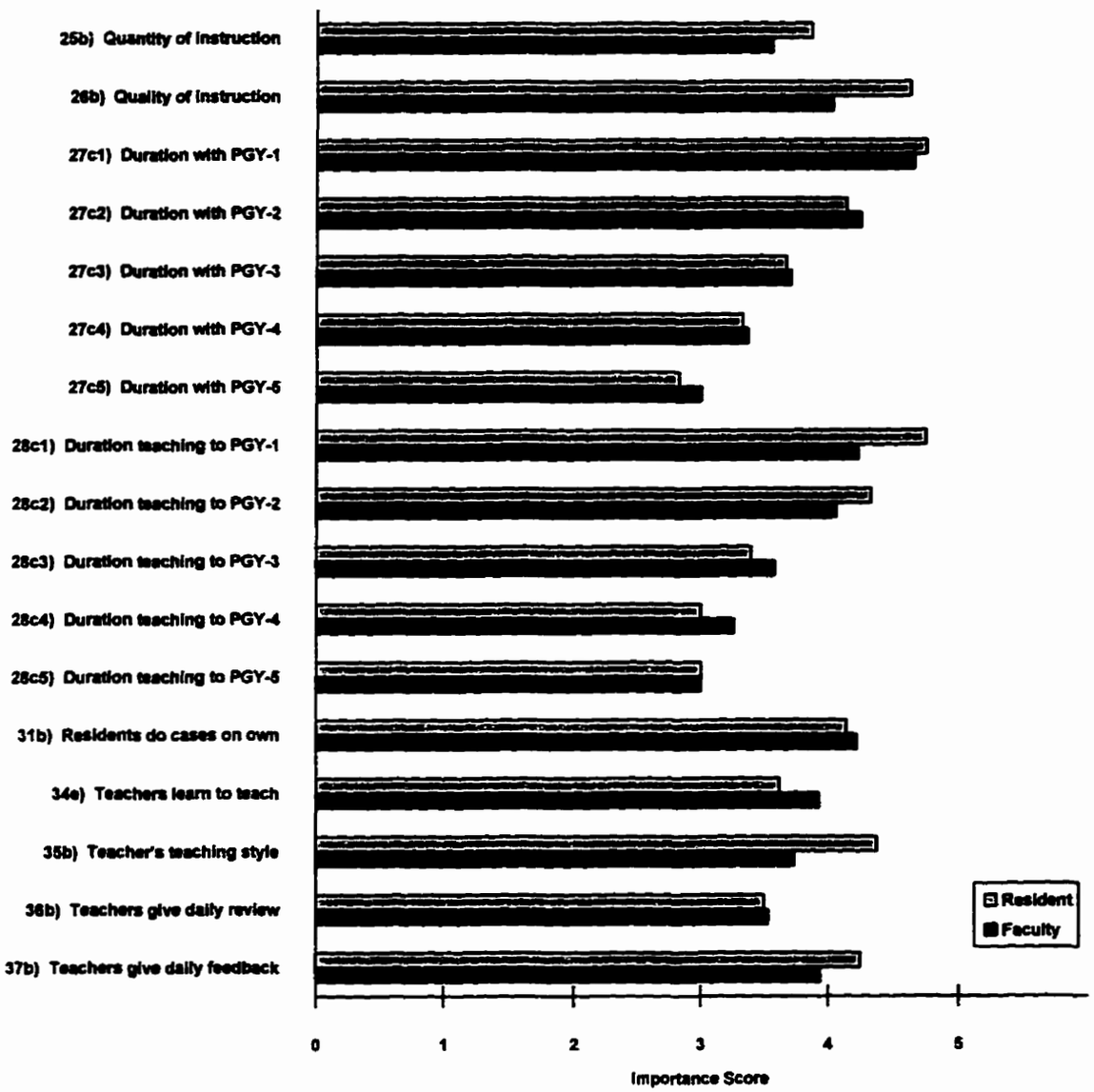


Figure 9 (continued)

Mean Scores for Theme 4 "Importance" Questions

Analyzed by Resident and Faculty Respondent Groups

give anaesthetics in the operating room (question 16b, faculty mean 4.71, resident mean 4.86). The next most important was that of the overall length of time that the teacher spends in the operating room with the PGY-1 resident (question 27c1, faculty mean 4.66, resident mean 4.75).

After these top three factors, faculty and residents were no longer in perfect agreement as to the overall ranking of factors. However, there was general agreement for the next twelve factors of importance (see Figure 10). In descending importance, this included the importance of (a) the length of time the teacher spends with the PGY-1 resident on teaching and learning (question 28c1), (b) the quality of instruction (question 26b), (c) residents posing questions to teachers (question 18d), (d) the teacher's teaching style (question 35b), (e) teaching during the maintenance part of the anaesthetic (question 20b), (f) the operating room environment (question 17b), (g) the length of time the teacher spends with PGY-2 residents on teaching and learning (question 28c2), (h) teachers providing residents with daily feedback (question 37b), (i) teachers posing questions to students (question 18c), (j) the overall length of time the teacher spends in the room with PGY-2 residents (question 27c2), (k) teachers considering the needs or wants of the resident (question 10b), and (l) residents doing cases completely on their own (question 31b).

The greatest difference of rankings between faculty and resident groups was seen for question 14c. Faculty ranked the importance of teaching attitudinal items 11th overall (out of 35) while residents ranked this factor 26th overall. Faculty and resident groups also differed greatly on their rankings of question 17b. Faculty ranked the importance of the operating room environment 5th overall while residents ranked this 19th overall. Similarly, for question 9, residents ranked higher (16th overall) than faculty (30th overall) the importance of the timing of the decision of the topic for the next day's learning encounter. As well, for question 35b, residents ranked higher (6th overall) than faculty

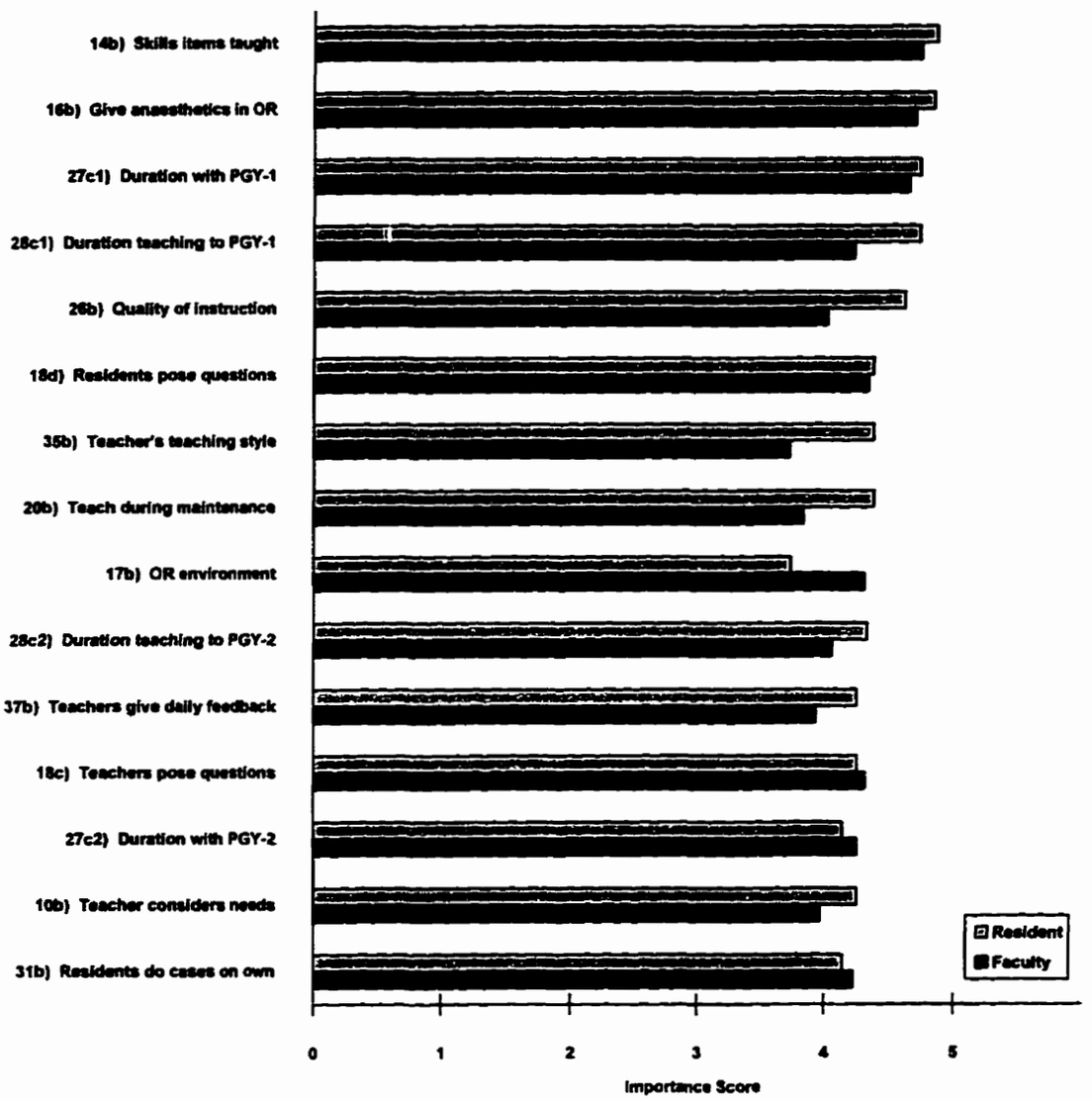


Figure 10

The Top 15 Ranked Theme 4 "Importance" Factors

Analyzed by Resident and Faculty Respondent Groups

(20th overall) the importance of the teacher's teaching style. For question 20b, residents again ranked higher (7th overall) than faculty (18th overall) the importance of teaching during the maintenance part of the anaesthetic.

However, despite these differences in rankings between faculty and resident groups, both groups ranked the 35 items in a similar order of importance. The Kendall *W* coefficient of concordance of the faculty and resident groups' rankings of Theme 4 questions was 0.91. This value did reach statistical significance (p=0.0026). Thus, this concordance unlikely was due to a chance observation.

Of the 35 Theme 4 items responded to by faculty and resident groups, only three items received a mean rating of less than 3 on the 5-point scale by either faculty or resident respondents (questions 12b, 22b, and 27c5). Thus, both faculty and residents felt that most of the Theme 4 factors were greater than *moderately important* for teaching and learning in the operating room. As well, both groups agreed on which factors were most and least important since their rankings of these 35 factors were similar.

Analysis Across All Four Thematic Areas

To determine the relative importance of factors across all four thematic areas, the analysis was repeated to include responses, in both faculty and resident groups, for all questions to which respondents answered on the 5-point "importance" scale. Figure 11 shows the distribution of the mean scores for both faculty and resident respondents to the top 15 ranked factors across all four thematic areas. Analysis of faculty responses over the 51 questions revealed a Kendall coefficient of concordance of 0.34, and this reached statistical significance (p<0.0001). Similar analysis of resident responses yielded a Kendall coefficient of concordance of 0.56, and this also reached statistical significance (p=0.0018). Thus, all faculty and residents within their respective groups responded in a

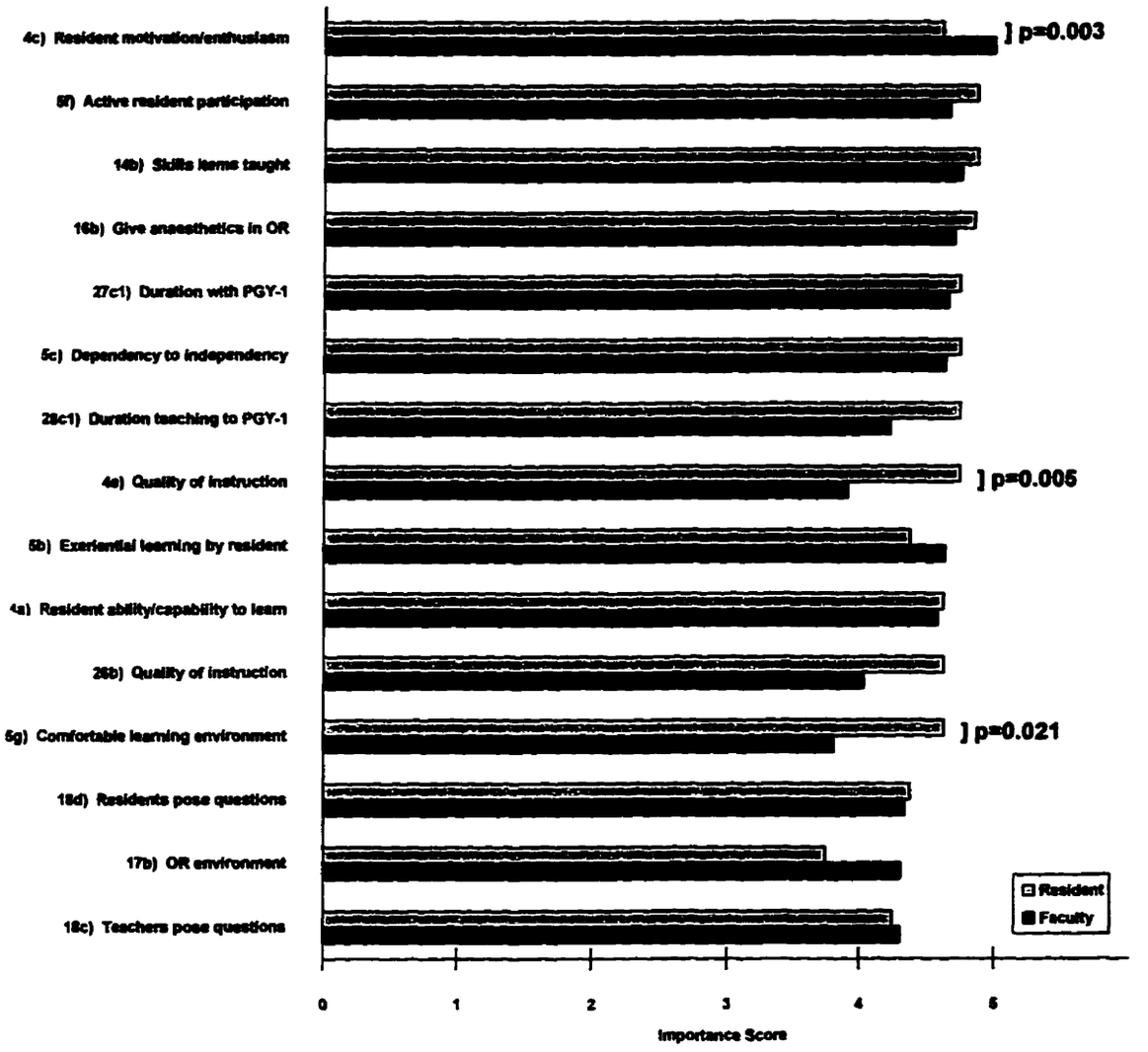


Figure 11

The Top 15 Ranked "Importance" Factors Across All Four Thematic Areas

Analyzed by Resident and Faculty Respondent Groups

similar fashion to all questions across the four thematic areas, and this was unlikely due to chance.

The factor ranked as most important by faculty across all four thematic areas was that of resident motivation (question 4c). The faculty mean score for this item was 5.00 out of a total possible of five. The resident mean score for this item was 4.62 and ranked 11th overall for resident respondents. Residents, on the other hand, ranked active resident participation (question 5f) as the most important factor across all four thematic areas. The resident mean score for this item was 4.88. The faculty mean score for this item was 4.67 and ranked 4th overall for faculty respondents.

Both faculty and residents were identical in their choices for the second and third ranked items across all four thematic areas. The second most important factor was that of skills items being taught in the operating room (question 14b). The faculty mean for this item was 4.76 and the resident mean was 4.88. The third most important factor was that of residents actually learning how to give anaesthetics in the operating room setting (question 16b). The faculty mean for this item was 4.71 and the resident mean was 4.86.

Below these top factors of importance, faculty and residents were not in perfect agreement as to the overall ranking of factors. However, there was general agreement for the next eleven factors of importance (see figure 11). In descending importance, this included the importance of (a) the overall length of time the teacher spends in the room with the PGY-1 resident (question 27c1), (b) the quality of instruction (question 4e), (c) the resident moving from dependency to independency (question 5c), (d) the length of time the teacher spends with the PGY-1 resident on teaching and learning (question 28c1), (e) experiential learning by the resident (question 5b), (f) the resident's ability or capability to learn (question 4a), (g) the quality of instruction (question 26b, an intra-questionnaire repeated question), (h) a comfortable supportive learning environment (question 5g), (i) residents posing questions to teachers (question 18d), (j) the operating

room environment (question 17b), and (k) teachers posing questions to students (question 18c).

The greatest difference in rankings between faculty and resident groups was seen for question 14c. Faculty ranked the importance of teaching attitudinal items 16th overall (out of 51) while residents ranked this factor 41st overall. Faculty and resident groups also differed greatly on their rankings of question 17b. Faculty ranked the importance of the operating room environment 10th overall, while residents ranked this 32nd overall. For question 9, residents ranked higher (24th overall) than faculty (45th overall) the importance of the timing of the decision of the topic for the next day's learning encounter. As well, for question 5g, residents ranked higher (8th overall) than faculty (27th overall) the importance of a comfortable supportive learning environment. For question 4e, residents ranked higher (5th overall) than faculty (21st overall) the importance of the quality of instruction provided. For question 34e, faculty ranked higher (20th overall) than residents (36th overall) the importance of teachers formally learning how to teach properly. Also of interest was the observation that the highest overall factor ranked by faculty was question 4c. Residents ranked the importance of the resident's motivation to learn 11th overall.

However, despite these differences in overall rankings between faculty and resident groups, both groups ranked the 51 items in a similar order of importance. The Kendall W coefficient of concordance of the faculty and resident groups' rankings of all "importance" questions across all four thematic areas was 0.90. This value did reach statistical significance (p=0.0004). Thus, this concordance unlikely was due to a chance observation.

Of the 51 items across all four thematic areas, the mean ratings were 3.51 and 3.84 (out of a maximum of 5.00) for faculty and resident groups, respectively. On the 5-point Likert-like importance scale, this equated to an average response between

moderately important and *important*. Of interest was the fact that the resident group tended to place a higher importance on all the factors than that placed by the faculty. However, this trend was not statistically significant. The lowest mean rating over all 51 items was given to question 27c5. The mean ratings for faculty and resident respondents were 3.00 and 2.83, respectively. Thus, the least important factor ranked by respondents was that of the overall length of time that the teacher spends in the room with the PGY-5 resident. However, on the 5-point importance scale, this still was rated just below *moderately important*.

Overall Important Factors

The first three questions posed to respondents on the Q2 questionnaire asked them to rank the top three most important factors they felt affected the teaching and learning processes in the operating room between an anaesthesia resident and a staff anaesthetist. This question prompted respondents to commence their reflections on the factors that may be involved. The body of the Q2 questionnaire then guided respondents through a variety of factors of consideration. At the completion of the Q2 questionnaire, after attention to and hopefully considerable reflection on these variety of factors, respondents were asked to rank the top five factors that they felt were of greatest importance to anaesthesia education in the operating room for any anaesthesia residency programme (question 38). Respondents were asked to rank these five factors from a list of 22 closed response categories and 6 open response categories (where the respondent could volunteer his or her own factor).

In fact, no respondent chose an open response category. As well, of the remaining 22 closed response categories, no faculty or resident respondent chose two particular categories. These were category number 24 (the importance of the PGY-3 year being exclusively Internal Medicine rotations) and number 27 (the importance of medical

students deciding on a career pathway so early on in their training). In addition, no resident respondent chose category number 5 (the importance of the resident's content knowledge), category number 9 (the importance of the faculty's tiredness), category number 12 (the importance of the faculty's content knowledge), or category number 17 (the importance of flexibility). Thus, faculty respondents ranked a total of 20 categories while residents ranked a total of 16 categories of important factors.

Some respondents had technical difficulty in answering this question and tried to rank, from one to five, the items within each subset of factors of the student, the teacher, the student-teacher interaction, the operating room, and the programme. Thus, these responses were disregarded as incorrectly completed. This resulted in a total response sample of 43 for this question (29 faculty responses and 14 resident responses). For those faculty and resident respondents who only completed the Q1 questionnaire, the responses to their final ranking of their top three most important factors also were included in this analysis.

For each respondent, their top ranked factor received a weighting of five, their second ranked factor received a weighting of four, their third ranked factor received a weighting of three, their fourth ranked factor received a weighting of two, and their fifth ranked factor received a weighting of one. The distribution of the weighted responses over the 20 categories by faculty and resident groups is shown in figure 12. This figure illustrates the percentage of faculty or resident respondents who gave their weighted responses to each of the 20 categories.

This overall pattern of weightings of the 20 factors was significantly different between faculty and resident groups (Pearson χ^2=73.97, df=19, p<0.00001). While this overall pattern of weightings of the 20 factors was found to be significantly different between faculty and resident groups, it was not known as to exactly which of the 20 factors was responsible for this difference. Thus, partitioning of the chi-squared

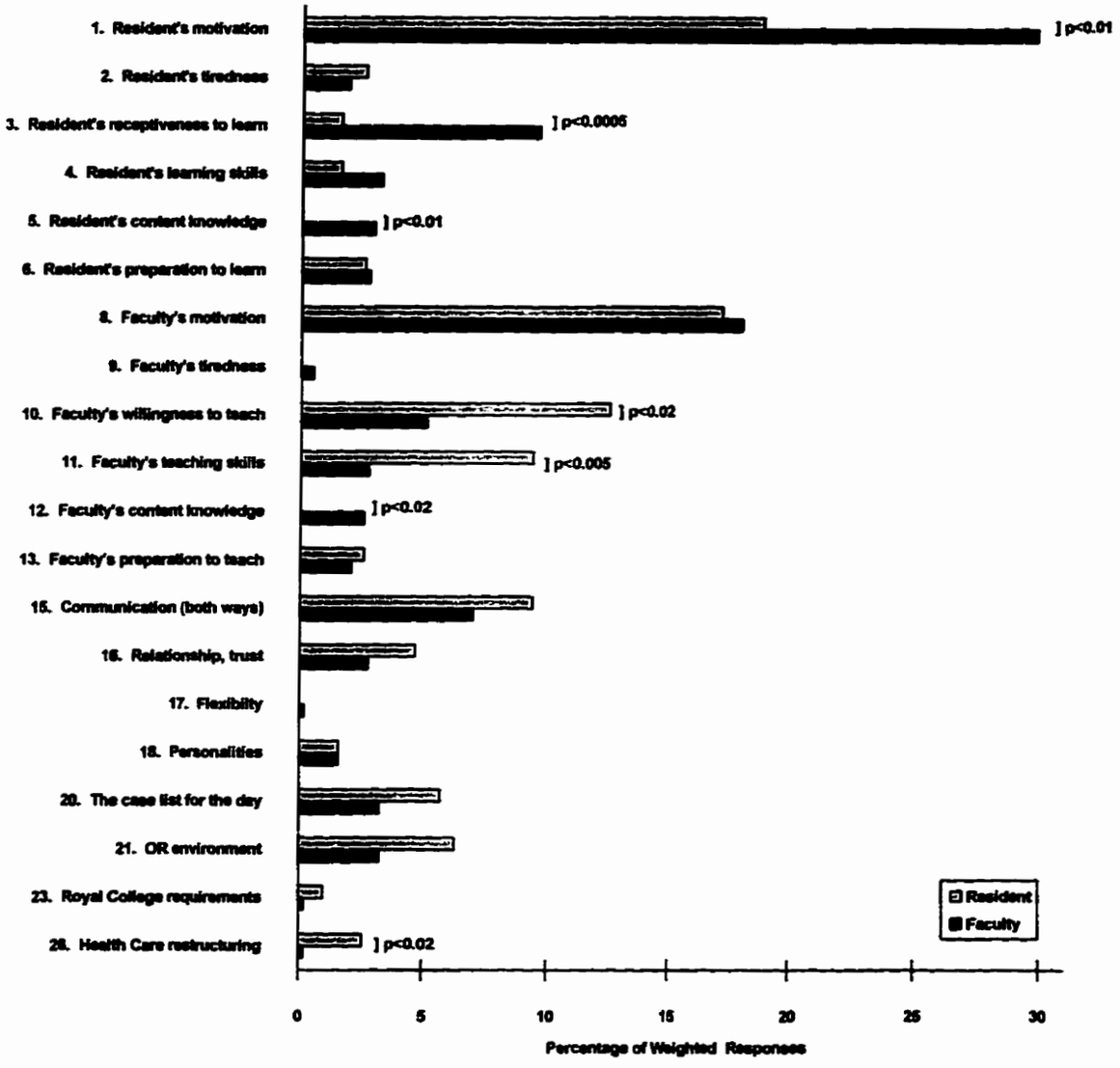


Figure 12

The Percentage of Weighted Responses Given by Respondents to Each Category Analyzed by Resident and Faculty Respondent Groups

contingency tables was done. This partitioning of the degrees of freedom in the 2 X 20 chi-squared contingency table allowed for the determination of the levels of significance between the weightings by faculty and resident respondents for each of the 20 factors (Castellan, 1965; see also Siegel & Castellan, 1988, pp. 118-123).

The overall factor ranked of greatest importance by both faculty and resident respondents was that of the importance of the resident's motivation and enthusiasm. Of faculty respondents, this accounted for 29.8% of the weightings given across the 20 factors ranked. For resident respondents, this accounted for 18.8% of the weightings given across the 16 factors ranked. Faculty placed a significantly larger weighting on this factor than residents (partitioned χ^2=7.75, df=1, p<0.01).

The second highest factor ranked by faculty and residents was the importance of the faculty's motivation and enthusiasm. This accounted for 18.0% and 17.2% of faculty and resident overall weightings respectively. There was no significant difference between weightings of this category between groups. Communication was given the third highest weighting by faculty. This tied for the fourth highest rating by residents. This category received 7.0% and 9.4% of the weightings for faculty and resident groups respectively. There were no significant differences in weightings between groups for this factor.

The faculty's willingness to teach was given the third highest weighting by residents and the fifth highest weighting by faculty. However, this difference in weighting was statistically significant between groups (partitioned χ^2=5.71, df=1, p<0.02). This represented 12.5% of the weightings given to this factor by resident respondents while it only represented 5.1% of the weightings given to this factor by faculty respondents.

The next most important factor ranked by faculty and resident respondents was that of the importance of the faculty's teaching skills. This accounted for 9.4% of resident

weighted responses but only 2.8% of faculty weighted responses. This difference in weighted responses was significant between groups (partitioned χ^2=8.13, *df*=1, p<0.005). Following this, the next most important factor ranked by faculty and resident respondents was that of the importance of the resident's receptiveness to learn. This accounted for 9.6% of faculty weighted responses but only 1.6% of resident weighted responses. This difference in weighted responses was significant between groups (partitioned χ^2=13.55, *df*=1, p<0.0005). The next most important factor ranked by faculty and resident respondents was that of the importance of the operating room environment. This accounted for 6.3% and 3.3% of weighted responses for resident and faculty groups respectively. There were no significant differences in weightings between groups for this category.

The seven categories listed so far represented the majority of weighted responses as stated by both faculty and resident groups with regard to the most important factors overall for teaching and learning in the operating room for any anaesthesia residency programme. These seven categories accounted for 75.6% and 75.2% of overall faculty and resident weighted responses respectively. The remaining thirteen categories thus represented the remainder of the approximately 25% of the weighted responses.

Significant differences between faculty and resident groups with regard to their weighted responses also existed for three other categories. Faculty more than residents gave a greater weighting to the importance of the resident's content knowledge (partitioned χ^2=6.82, *df*=1, p<0.01) and the importance of the faculty's content knowledge (partitioned χ^2=5.81, *df*=1, p<0.02). On the other hand, residents more than faculty gave a greater weighting to the importance of health care restructuring (partitioned χ^2=6.43, *df*=1, p<0.02). For all other categories, there were no significant differences for weighted responses by category between faculty and resident groups.

Overall Important Factors Using Component Factors of the Comprehensive Model

The 20 categories given weighted rankings by faculty and resident respondents may be grouped according to the main components of the Comprehensive Model of Teaching and Learning (Figure 4). Thus, categories 1 to 6 encompass factors of the student, categories 8 to 13 encompass factors of the teacher, categories 15 to 18 encompass factors of the student-teacher interaction (the learning encounter), categories 20 to 21 correlate to factors of the operating room (the learning microenvironment), and category 23 and 26 relate to the factor of the anaesthesia residency programme (the macroenvironment). Thus, analysis may be made grouping the weighted responses into these five categories based on the Comprehensive Model of Teaching and Learning.

The distribution of the weighted responses over these five categories by faculty and resident groups is shown in Figure 13. This figure illustrates the percentage of faculty or resident respondents who gave their weighted responses to each of the five main categories as defined in the Comprehensive Model of Teaching and Learning. The overall pattern of weighted responses over the five categories differed significantly between faculty and resident groups (χ^2=36.72, df=4, p<0.0001). Again, partitioning of the 5 X 2 chi-squared contingency table was done to allow the determination of the levels of significance between the weightings by faculty and resident groups for each of the five factors.

Faculty placed the greatest amount of importance on factors relating to the student. Overall, this accounted for 50.3% of faculty weightings over the five categories. Residents placed the greatest amount of importance on factors relating to the teacher. Overall, this accounted for 41.7% of resident weightings over the five categories. For second place, faculty placed importance on factors relating to the teacher (31.0% of weightings overall) and residents placed importance on factors relating to the student (27.1% of weightings overall). For third place, both groups then placed importance on

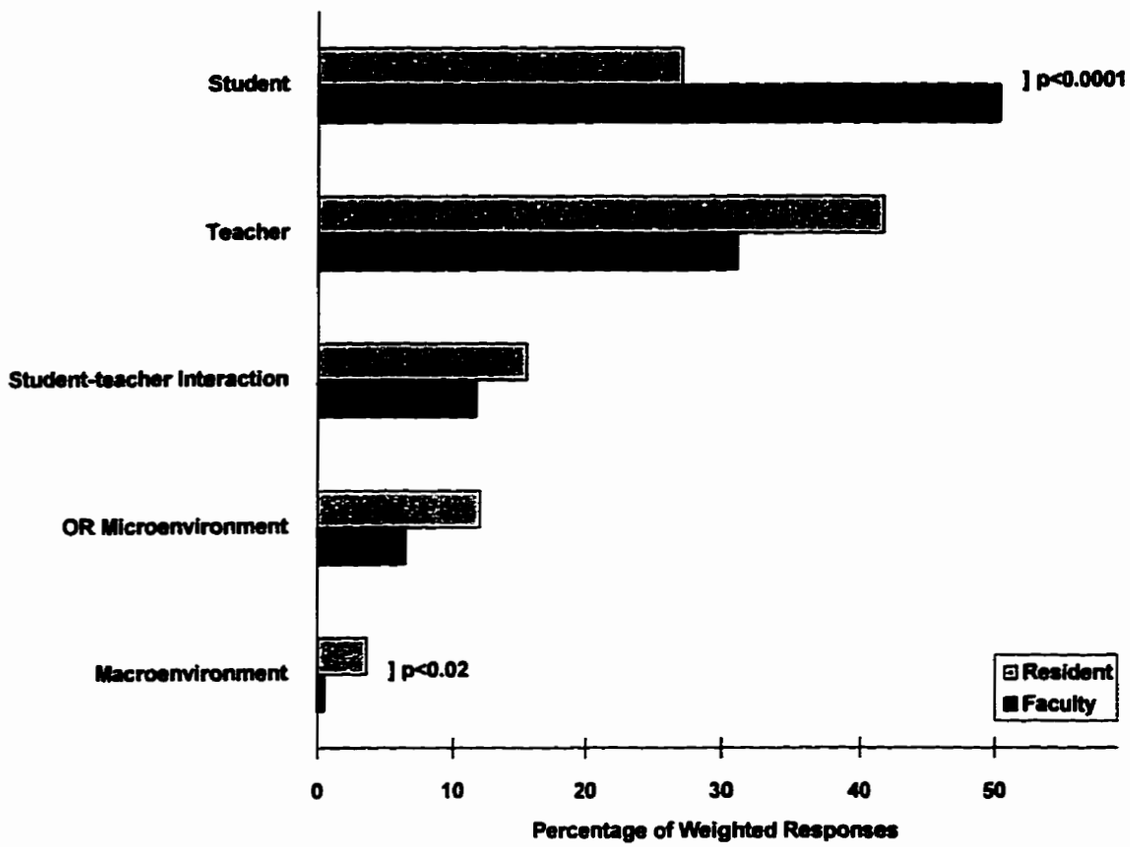


Figure 13

The Percentage of Weighted Responses Given by Respondents

to Each Category of the Comprehensive Model

Analyzed by Resident and Faculty Respondent Groups

the student-teacher interaction (11.7% and 15.6% of the overall weightings for faculty and residents respectively). For fourth place, both groups placed importance on the operating room learning microenvironment respectively (6.5% and 12.0% of the overall weightings for faculty and residents respectively). Of least importance was that of the macroenvironment, agreed upon again by both groups (0.5% and 3.6% of the overall weightings for faculty and residents respectively). Faculty placed a significantly larger weighting on the factor of the student than resident respondents (partitioned χ^2=26.16, df=1, p<0.0001). Residents placed a significantly larger weighting on the factor of the macroenvironment than faculty respondents (partitioned χ^2=6.28, df=1, p<0.02). Thus, from the partitioned results, one may see that most of the difference in the overall pattern of responses over the five categories between faculty and resident groups was due to the difference in their weighting of the importance of the factor of the student.

Factors of the student, teacher and the student-teacher interaction accounted for the majority of weighted responses in both the faculty and resident groups. For faculty, this accounted for 93.0% of their overall weightings across the five categories and for residents this accounted for 84.4% of their overall weightings across the five categories. Thus, factors related most centrally to the student-teacher interaction accounted for the greatest proportion of weight given to all factors of importance to the whole teaching and learning processes. Factors related more externally to the student-teacher interaction, such as the administrative policies of the Royal College of Physicians and Surgeons of Canada or the influence of health care restructuring, were felt to be of less influence and importance on teaching and learning processes in the operating room.

Extent to Which The University of Calgary Programme Meets the Ideal

For each one of the factors that the respondents chose as their top five most important factors that influence teaching and learning in the operating room for any

anaesthesia residency programme, respondents also were asked to rate the extent to which the educational practices or factors at The University of Calgary anaesthesia residency programme meet respondents' perceived ideal. This rating was done on a 5-point Likert scale: *strongly disagree, disagree, neutral, agree, and strongly agree*. Coding of responses was from one (*strongly disagree*), to five (*strongly agree*). Thus, high scores reflected those educational practices or factors at The University of Calgary programme that were felt to most closely meet the perceived ideal whereas low scores reflected educational practices or factors that were felt to be furthest from the perceived ideal. Not all respondents rated The University of Calgary anaesthesia programme to all of their top five ranked factors, nor did all respondents complete this section. Thus, since the response rate varied considerably for each factor rated, the response rate will be specifically mentioned below.

There were no significant differences between mean ratings for faculty and resident groups for any of the factors. Five factors were rated most frequently by respondents. The factor of resident motivation received 32 ratings, with a mean score of 3.13 on the 5-point Likert scale. Thus, faculty and resident respondents were just slightly on the agree side of *neutral* that The University of Calgary programme meets the perceived ideal for resident motivation. Similarly, the factor of faculty motivation received 27 ratings, with a mean score of 3.15. The factor of communication received 18 ratings, with a mean score of 3.33. The factor of the faculty's willingness to teach received 15 ratings, with a mean score of 3.13. The factor of the student's receptiveness to learn received 13 ratings, with a mean score of 3.38.

The factor having the highest mean score received five ratings. This was the factor of the resident's learning skills. This factor had a mean score of 4.00 on the 5-point Likert scale. Thus, the five respondents agreed that The University of Calgary programme meets the perceived ideal for resident's learning skills. The second highest

score was given to the factor of relationship or trust. Four ratings were given to this factor, with a mean score of 3.75. The third highest score was given to the factor of flexibility. Five ratings were given to this factor, with a mean score of 3.40.

Four factors received ratings below 3.00, or on the disagree side of *neutral*. These were factors that respondents felt that The University of Calgary programme was furthest from the perceived ideal. The factor of the operating room environment received 8 ratings, with a mean score of 2.75. The factor of the resident's tiredness received 5 ratings, with a mean score of 2.80. The factor of faculty content knowledge received 3 ratings, with a mean score of 2.67. The factor of health care restructuring received 2 ratings, with a mean score of 1.00.

Respondents were given the opportunity of responding in an open-ended fashion as to their thoughts on potential forces that may be inhibiting The University of Calgary programme with respect to the various important factors that they had listed. Comments regarding the inhibiting forces to resident motivation to learn were related to the selection process for anaesthesia residents. Some respondents wrote that since residents currently choose their career pathway so early in their training, some may find themselves in the wrong specialty. As well, other respondents suggested that it is difficult to always select the most highly motivated individuals. Service requirements were also mentioned as inhibitors of resident motivation to learn since the resident may be tired from such activities and the fact that residents frequently have other demands on their time over and above their learning. Personal life problems including problems with relationships were also mentioned as inhibiting factors to resident motivation to learn. Other comments included, (a) "residents have an incomplete knowledge of the attitudes and work ethic required of residents as opposed to students", (b) "numerous residents do not take on an attitude of responsibility for all aspects of care of each patient", (c) "often residents treat this as a job, not as preparation," (d) "residents frequently mirror the staff's enthusiasm

which is limited on occasion", and (e) "there is a lack of light (i.e., jobs) at the end of the tunnel."

Similar responses were received as to the forces inhibiting the resident's receptiveness to learn. However, another item listed as an inhibiting force to resident's receptiveness to learn included the impression that there is intimidation by the faculty and other members of the operating room team that causes a barrier to resident education. The resident may build up a defense to this as he or she may be "afraid of not knowing." As well, residents may want to stay with a particular way of doing things because it has proven successful. This may be seen by faculty as a desire not to expand one's horizons and interpreted as an unwillingness to learn something new.

Comments regarding the inhibiting forces to faculty motivation to teach included the observation that faculty are overworked, overstressed, tired, and have many concurrent activities that demand their time. Students, as well as faculty, were able to identify these as problematic forces. Recent healthcare reform was recognized as a contributing factor to the decline in staff motivation. One resident stated that faculty appeared "depressed" due to job insecurity and high workload because of recent healthcare reform. Another resident stated that "healthcare reform has sapped faculty motivation to teach in the past few years." Other factors identified as inhibiting faculty motivation to teach included (a) the impression that faculty, in general, are not hired with this as a high priority, (b) random exposure of faculty to residents, (c) time constraints, and (d) personal factors. Faculty stated that they receive little remuneration or rewards for teaching, that there is a lack of appreciation for their non-clinical activities, and that they receive negative feedback from residents regarding their teaching abilities. One faculty member stated, "at no time in my career have I ever been taught how to teach. Therefore, I think this lack of skill and knowledge on teaching methods is my greatest weakness as a teacher." In fact, only 20.6% of faculty stated that they received any

formal teaching on how to teach (question 34a). Less than half of faculty (45.7%) stated that they had ever participated in a workshop on how to teach (question 34b). Of faculty, 55.9% stated that they teach the way in which they were taught (question 34c) and 57.1% stated that they teach by just trying different teaching methods on their own (question 34d). However, both faculty and resident respondents agreed that it is *important* that teachers formally learn how to teach properly.

Similar responses were received as to the forces inhibiting the faculty's willingness to teach. However, another item that was felt to lead to faculty unwillingness to teach was the infrequent contact with residents leading to the feeling, "so why bother?" Also, one respondent wrote, "occasionally staff feel the residents think they know better and this unfortunately leads to a few staff having a 'to hell with them' attitude." Additionally, the sense that a resident is unresponsive and noncommitted was listed as a cause of poor faculty willingness to teach.

Barriers to effective communication between faculty and residents were identified. This included the difficulty in establishing effective communication with a particular resident or faculty member when they work so infrequently together. It was stated also that they infrequently establish contact with each other at informal gatherings, which could allow the development of integrity which fosters trust. Again, the time pressures, job constraints, noisy environment, busy cases, fatigue, and other operating room personnel may interfere with effective communication. The example given was surgeons who preferred a quiet operating room. Additionally, the feeling of intimidation and lack of self-confidence on the part of the resident was identified as a barrier to effective communication. Lastly, the differing expectations on the part of the student and teacher were recognized as a potential source of ineffective communication.

The factors that received low ratings by faculty and residents also received several comments regarding sources of constraint. The operating room environment was found

to be less than ideal at The University of Calgary. Factors of the operating room that were identified as inhibiting operating room teaching and learning included the noise level, anxiety level, personalities of the other operating room personnel, production pressure, extended case duration leading to fatigue, excessive workload, emphasis on work efficiency and not on teaching, busy cases, and a crowded work area. Resident tiredness also was found to be problematic. Factors relating to this were listed as being service requirements including on-call responsibilities, the increasing length of the working day even when not on-call, and the increasing workload overall. One resident commented, "no matter how much you want to learn, it's hard to retain things if you're not conscious." Faculty content knowledge was also identified as less than ideal. Factors related to this were listed as being the lack of time to read and prepare, the absence of being taught how to teach, and the low priority given to continuing medical education in the department.

Identifying Differences Between Current and Optimal Educational Practices

Results across all questions relating to Theme 4 Mechanics questions looked at several teaching practices. Respondents were asked to determine the current frequency of that particular educational practice and also to relate the ideal importance of that practice. An examination of each of these educational practices will now be presented chronologically according to the preinstruction, during instruction, and postinstruction sequence.

Both faculty and residents agreed that it is currently the teacher who, for the majority (70%) of the time, decides on the topic for the day, but that ideally the student should be more involved in this decision. Optimally, respondents felt that the student and the teacher should share this responsibility (50:50). Currently, the topic is decided on the morning of the day in the operating room, but respondents felt that optimally it should be

decided more often the evening before. Residents placed more importance on this than faculty (Mann-Whitney U, p=0.035).

Currently, the teacher *infrequently* asks the needs or wants of the resident and only *infrequently* does the student tell their teacher their own needs and wants (faculty felt that the students more infrequently stated their needs or wants to the teacher than that alleged by residents, p=0.027), but both faculty and resident respondents felt that these were *important* activities that should be done. Currently, the teacher only *infrequently* prepares a lesson plan, but this activity was felt to be *moderately important* by both faculty and resident respondents.

There were significant differences between faculty and resident groups regarding their opinions as to the percentage of time currently spent in the operating room on teaching knowledge, skill, or attitudinal items. Residents, more than faculty, felt that a greater percentage of time currently was being spent teaching knowledge items (70% vs. 43%, p=0.0002) while faculty, more than residents, felt that a greater percentage of time currently was being spent teaching skill (35% vs. 21%, p=0.013) and attitudinal items (21% vs. 9%, p=0.044). In terms of the ideal situation, faculty and resident respondents agreed that the largest percentage of time should be spent by teachers teaching knowledge items (46% and 61% of the time respectively for faculty and resident respondents), followed next by skill items (34% and 26% respectively) and then finally by attitudinal items (20% and 13% respectively).

However, in terms of the importance of teaching in the knowledge, skill, or attitudinal domain, both faculty and resident respondents felt that items in the skills domain were the most important to be taught, followed by knowledge and attitudinal items. This inconsistency between the opinion that the greatest percentage of time should be spent teaching knowledge while the most important domain to teach is that of skills creates a discrepancy. Perhaps respondents realized that the amount of available time to

teach knowledge items is greater than the time or opportunity for teaching skills items, but in terms of importance, respondents realized that residents may only receive high-quality, real-life skills training in the operating room. Skills training outside of the operating room may lack this real-life experience, while the teaching of knowledge items outside of the operating room may be accomplished more readily.

Results indicated that there is a matching of current to ideal practice whereby the teaching is being related to the cases done on that day in the operating room. Both faculty and resident respondents felt that current and ideal anaesthesia training gains great advantage in being taught in the actual operating room environment. This rated very highly on the importance scale. However, the operating room environment was felt to interfere *occasionally* to *frequently* with operating room teaching. The current situation was felt to be less than ideal. Faculty and resident respondents agreed that it is *occasionally* difficult for the resident to carry out a learning encounter in the operating room while giving an anaesthetic.

Both faculty and residents felt that the teacher currently asks the majority of questions in the operating room (65%) but both agreed that there should be a more even split between who asks questions (50:50). Both respondent groups felt that it is more important that students pose questions to teachers rather than teachers posing questions to students. Both respondent groups felt that the current quality and quantity of teaching in the operating room was about *average*, or slightly below *average*. Quality of instruction was rated as being *important* to *very important* for resident respondents. Quantity of instruction for residents was less important than quality, but still of greater than *moderate importance*.

Both faculty and residents stated that the resident *infrequently* to *occasionally* completes cases on their own. Ideally, both groups felt that it is *important* that residents do so. Even when the resident completes cases on their own, they *infrequently* to

occasionally feel worried or frustrated. Similarly, their supervisors (teachers) also only *infrequently* to *occasionally* feel worried or frustrated that the resident is completing a case on their own.

Residents, more than faculty, felt that the current teaching style of the teacher had impact on teaching and learning in the operating room (p=0.026). There was a trend for students, more than faculty, to place a greater importance on the teacher's teaching style (p=0.058). Residents, more than faculty, reported that the review at the end of the day was currently *infrequent*. However, both felt that this practice is *moderately important*. For daily feedback, both faculty and residents felt that this currently was *occasionally* to *frequently* being practiced. Daily feedback was rated by both groups as being *important* to *very important*.

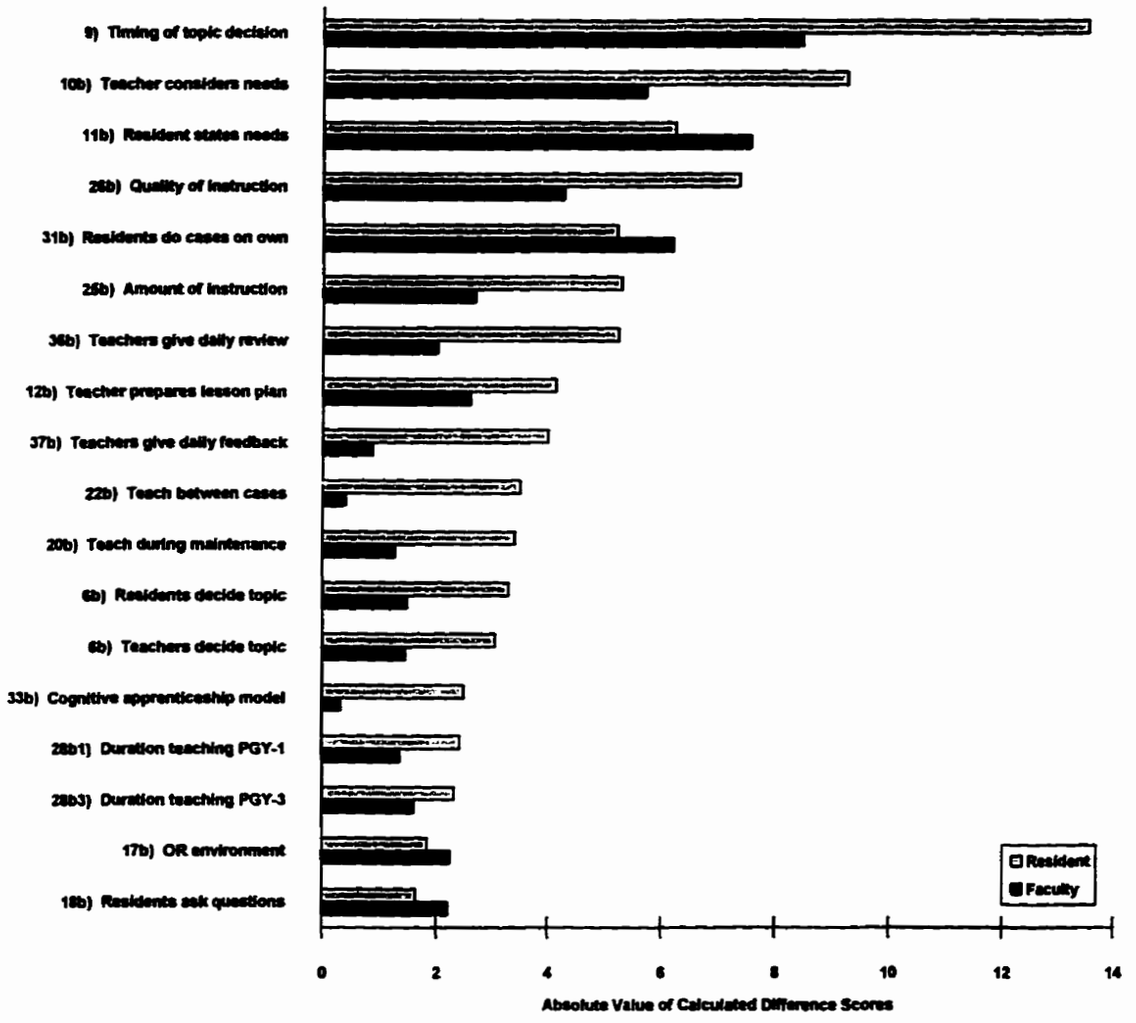
The questions for the Theme 4 Mechanics of the Learning Encounter also were structured so that the magnitude of difference between the current and optimal level of each educational practice could be determined. For each educational practice, the respondent was asked to give their opinion as to the frequency with which that educational practice was being performed currently. A paired question also asked the optimal frequency or importance that should be placed on that particular educational practice. A large difference between the current frequency and the optimal frequency (or relative importance) would give an indication that the particular educational practice is currently far from optimal.

To determine which educational practices are currently the furthest from ideal, all values were first transformed to the 5-point scale (see Appendix D for these transformation methods). Then the absolute difference between the current frequency and the optimal frequency (or importance level) was calculated. This was done since too much of a particular educational practice above optimal in fact may not be better than optimal. For example, teaching or learning skills items in the operating room is

important, but teaching or learning exclusively skills items and disregarding knowledge or attitudinal items may not be optimal.

A listing of those educational factors that had the greatest absolute difference between current and optimal practice may give some insight into those educational practices that may need improvement. However, the absolute difference may not be largest for educational practices that are felt to be most important overall. If efforts are to be taken to improve any educational practice, it should be done for those that are deemed most important overall. Thus, the absolute difference between the current frequency and the optimal frequency (or level of importance) was multiplied by the overall importance score given to that educational practice. Thus, for the case where the current practice is furthest from ideal for a most important factor, this calculated difference will yield a maximum value of 25 using the 5-point scale (i.e., if the current practice is zero and the ideal practice is five out of five for the greatest importance, then $|5\text{-}0| \cdot 5 = 25$). For the case where the current practice is exactly ideal, the value for the calculated difference will be zero, no matter the degree of importance of that factor.

This analysis was done for each educational practice for the grouped responses given by faculty and resident respondents. Figure 14 shows the distribution of the calculated difference scores between current and optimal practice for all educational practices examined in Theme 4 questions. Faculty and residents identified similar educational practices that they felt were currently far from optimal for important educational practices. This included (a) the timing of the next day's topic (question 8), (b) teachers considering the needs and wants of the student (question 10), (c) the resident telling the teacher his or her needs and wants (question 11), (d) the quality of instruction (question 26), (e) residents doing cases completely on their own (question 31), (f) the amount of time the teacher actually spends on teaching (question 25), (g) teachers



(Figure 14 continues)

Figure 14

Distribution of Calculated Difference Scores Between Current and Optimal Practice Analyzed by Resident and Faculty Respondent Groups

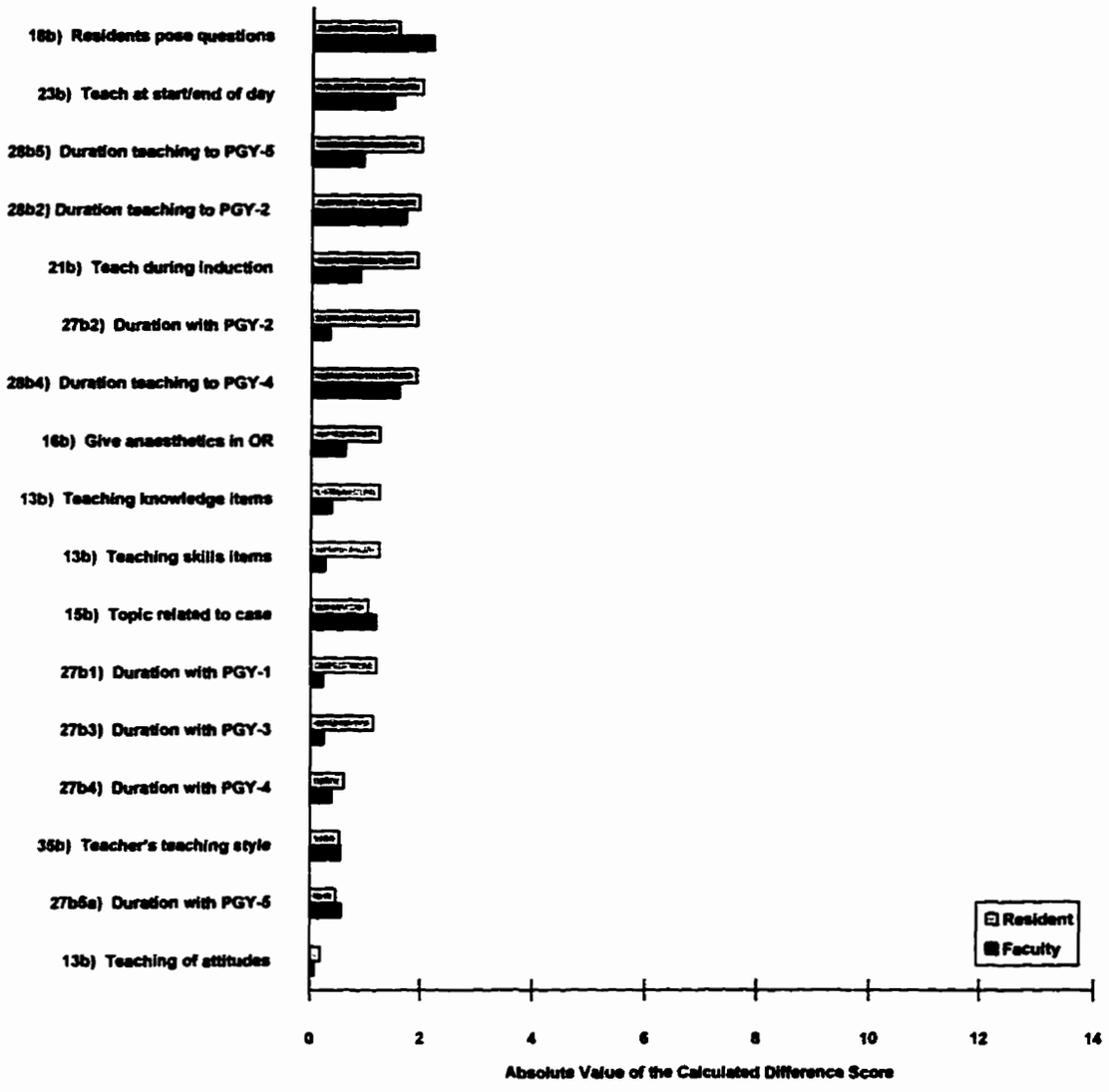


Figure 14 (continued)

Distribution of Calculated Difference Scores Between Current and Optimal Practice Analyzed by Resident and Faculty Respondent Groups

reviewing with the resident the major points of the day (question 36), and (h) teachers preparing a lesson plan (question 12).

As well, faculty and resident respondents identified, in a similar fashion, educational practices that were currently close to optimal, or fairly close to optimal but not very important overall. This included (a) the teaching of attitudinal items (question 13a/biii & 14c), (b) the level of frustration or worry between the student and teacher in having the student do cases completely on their own (question 32), (c) the overall length of time that the teacher spends in the operating room with a PGY-5 resident (question 27a/b/c), (d) the teacher's teaching style (question 35), and (e) the overall length of time that the teacher spends in the operating room with a PGY-1 or PGY-3 or PGY-4 resident (question 27a/b/c).

A comparison of the pattern of these absolute calculated differences between faculty and resident respondent groups over the 35 items revealed a Kendall coefficient of concordance of 0.85, and this reached statistical significance (p=0.0066). Thus, both faculty and resident groups had similar opinions regarding the educational practices that were close to or far from ideal, and this was unlikely due to a chance observation.

Over the 35 items, the faculty mean for the absolute calculated difference between current and ideal practice was 1.85 (on a total 25 scale). Likewise, the resident mean was 2.97. Thus, there was a trend for students to feel that current practices were further from ideal than faculty. However, current practices appear to be fairly close to ideal, overall.

Corroboration with the Prior Work of Paget, Lambert, and Eaton

The work of Paget and Lambert (1976) suggested that teaching and learning in the operating room may be inhibited by the factors of noise in the operating room, the necessity for being quiet for the surgical team, inadequate space in the operating room, the time requirements for monitoring the anaesthetic care of the patient, the obtrusiveness

of the wearing of facemasks, and the inadequacy of face-to-face interactions. The Q1 questionnaire asked respondents to rate (on the 4-point Likert-like scale of *never, sometimes, usually, and always*) how frequently each of these currently limits their educational interactions in the operating room (question 38, 39, and 40).

Overall, the effect of noise received mean ratings of 2.1 (on the 4-point scale) and 2.2 by faculty and resident respondents respectively (i.e., *sometimes*). The effects of the necessity for being quiet received mean ratings of 2.0 (*sometimes*) and 1.0 (*never*) respectively while the factor of inadequate space received mean ratings of 1.9 and 1.7 respectively (slightly less frequent than *sometimes*). The effects of the time requirements received mean ratings of 2.5 (between *sometimes* and *usually*) and 3.2 (just higher than *usually*) respectively while the factor of the wearing of facemasks received mean ratings of 1.7 and 1.4 (between *never* and *sometimes*) respectively. Finally, the factor of face-to-face interactions received mean ratings of 2.8 and 2.5 (slightly less frequently than *usually*) respectively. Thus, these factors do affect teaching and learning interactions between students and teachers in the operating room, but to a minor extent compared to other factors studied in this thesis. Of interest is the observation that residents (students) appear to be more greatly affected by the time requirements of concurrent clinical and educational activities than are faculty (teachers).

Lambert and Paget (1976) identified two time phases for student-teacher interactions in the operating room. They labeled Phase I as the period during the induction of anaesthesia (or a time of rapid change during the maintenance part of the anaesthetic) and Phase II as a quiet, stable period during the maintenance part of the anaesthetic. They concluded that teaching be restricted to Phase II except for learning-by-doing during Phase I situations.

The Q2 questionnaire asked respondents their opinions as to the timing of teaching in the operating room, both currently and ideally. In addition to Phase I and II

situations, respondents also were asked their opinions on teaching between cases (defined now as Phase III) or at the beginning or end of the day (defined now as Phase IV). Figure 15 shows the distribution of responses for faculty and resident respondents over the four phases (questions 20-23). "Ideal" responses were answered on the 5-point Likert-like importance scale while the "current" responses were answered on the 5-point frequency scale.

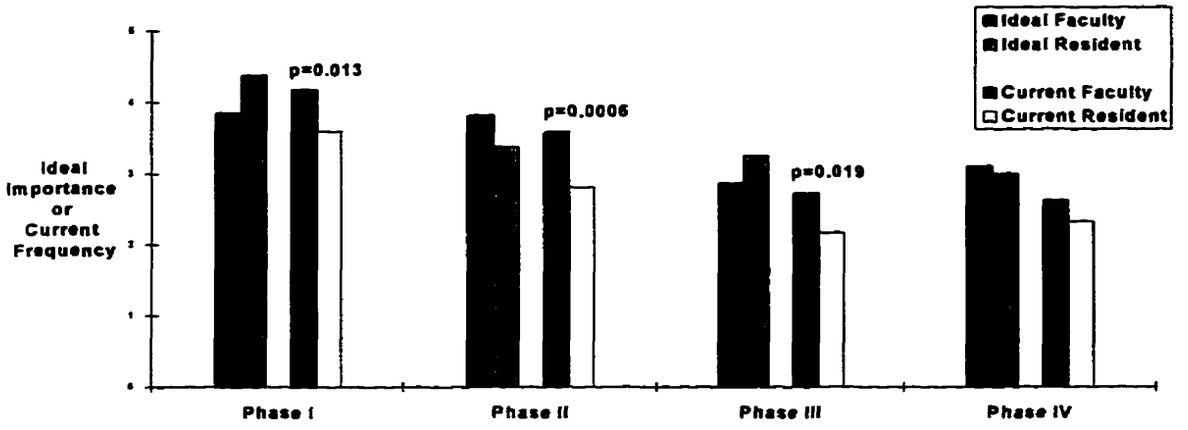


Figure 15.

Ideal Importance and Current Frequency of Teaching by Phase

Analyzed by Faculty and Resident Groups

Currently, it appears that most teaching is being done during Phase I and II. However, faculty and resident groups differed in their agreement as to the current frequency of teaching during Phase I, II, and III. The faculty means on the 5-point frequency scale were 4.18, 3.59, and 2.73 for Phase I, II, and III teaching respectively. Likewise, the resident means for these three phases were 3.60, 2.81, and 2.17 respectively. Corresponding levels of significance between faculty and resident means were p=0.013, p=0.0006, and p=0.019 respectively (Mann-Whitney U). Thus, it appears

that faculty are of the opinion that they currently teach more frequently during each of the Phase I, II, and III situations than that perceived by residents. Of interest is the observation that current Phase III and IV teaching is undertaken *infrequently* to *occasionally*.

Specifically looking at Phase II teaching, question 24 asked respondents if they felt that residents had difficulty carrying out a learning encounter in the operating room while giving an anaesthetic or monitoring a patient. Faculty and resident respondents both agreed (mean of 3.38 and 3.13 respectively) that residents *occasionally* to *frequently* had such difficulty.

When considering the ideal phase during which to teach, responses showed no significant differences between faculty and resident groups. Both agreed on the importance of Phase II teaching. However, residents also recognized the importance of Phase I teaching. Perhaps they referred to the teaching and learning of the important manual, cognitive, and problem-solving skills required during the induction and emergence phases of anaesthesia. Of interest is the observation that Phase III and IV teaching were rated as being *moderately important*.

Paget and Eaton (1977) showed that a tutor spent approximately one-half of their time actually present in the operating room with the student and interacted with the student for about one-third of that time. However, this was not investigated considering the level of training of the student. This study asked faculty and residents to give their opinions regarding both the current and ideal (a) percentage of time that the teacher currently is spending (ideally should spend) in the operating room with the student, (b) the percentage of that contact time that the teacher is spending (should spend) on teaching and learning, and (c) the absolute length of time (in hours) that a teacher and student are spending (should be spending) on teaching and learning in the operating room on an average day (questions 27, 28, and 29 respectively). Respondents were asked to break

this down by the training level of the resident (PGY-1 to PGY-5). Distribution of the results are shown in Figure 16.

Currently, both faculty and residents agree that there is a decline in the percentage of contact time the teacher spends in the operating room as the resident becomes more senior. This goes from a high of 85-88% for the most junior residents (PGY-1) which progressively decreases to a low of 18-30% for the most senior residents (PGY-5). This observation is in keeping with the concept of graded responsibility. However, the faculty believe that they spend more time in the operating room with the residents as compared to the impression perceived by the residents. This difference was statistically significant for the PGY-3 and PGY-5 year (Mann-Whitney U, p=0.024 and p=0.047 respectively). There was a similar trend for the PGY-2 and PGY-4 years (p=0.081 and p=0.056 respectively). Residents felt that the direct faculty presence in the operating room currently declines more rapidly and to a lower level over the five year residency programme than that perceived by faculty.

As well, there is a similar decline in the percentage of contact time that a teacher currently spends on teaching and learning with residents as they progress through the anaesthesia residency programme. Faculty and residents gave similar responses with a high of 40-53% of the contact time spent on teaching with a PGY-1 resident that progressively decreases to a low of 30-35% of the contact time with a PGY-5 resident. A similar observation was made that faculty tend to believe that they spend more time teaching to the residents than the impression perceived by the residents.

Similar patterns were obtained from faculty and resident respondents regarding the actual number of hours per day currently spent on teaching and learning in the operating room. While there were no statistically significant differences between faculty and resident groups, faculty again claimed a higher amount of engaged teaching time than that perceived by residents. For the faculty group, they believed that they currently spend

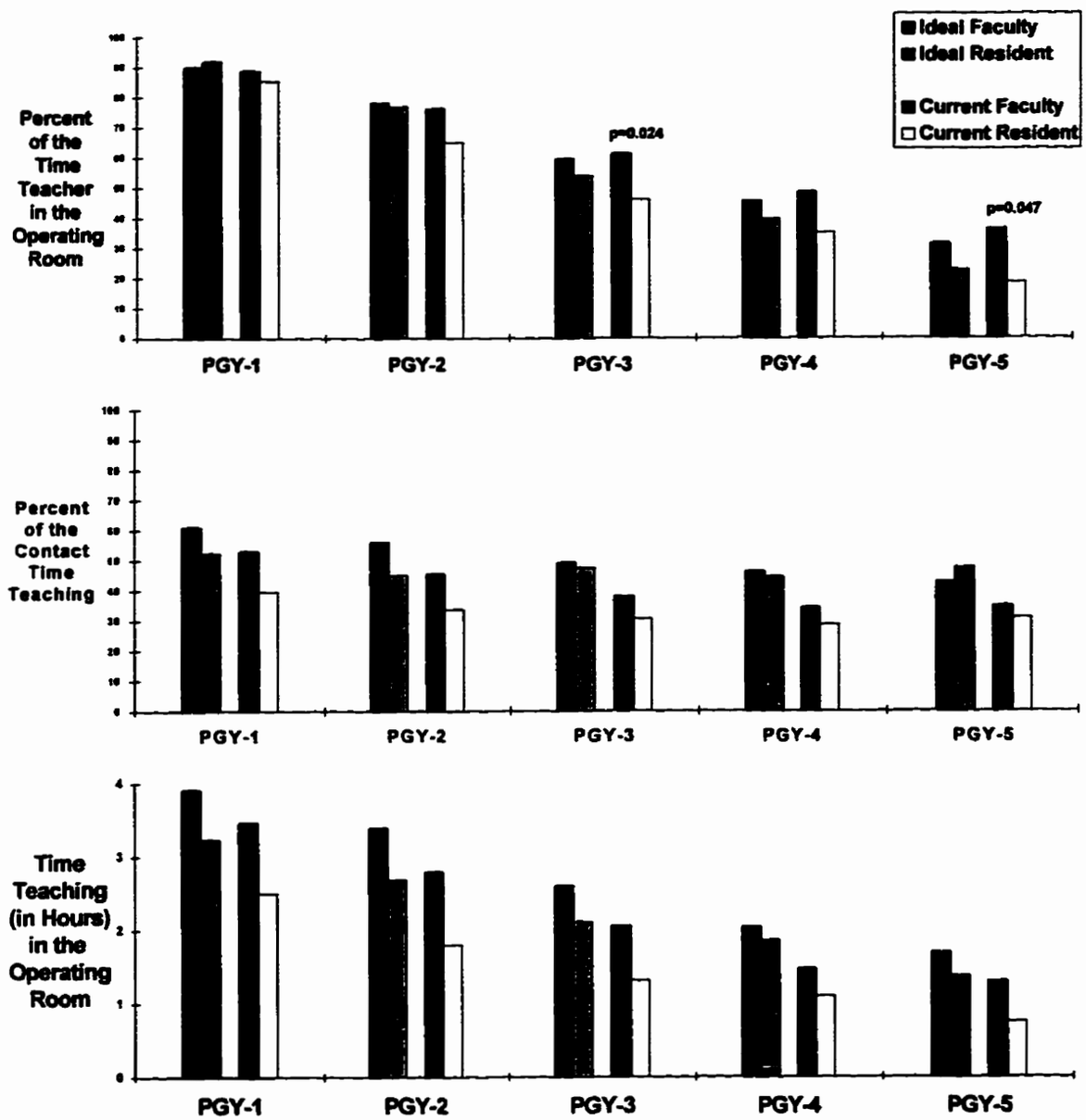


Figure 16.

Opinions Regarding the Ideal and Current Percent of the Time Teacher in the Operating Room, Percent of the Contact Time Teaching, and the Time Teaching (in hours) in the Operating Room. Analyzed by Faculty and Resident Respondents.

an average of 3.46 hours per day with a PGY-1 resident on teaching and learning that progressively decreased to an average of 1.30 hours per day with a PGY-5 resident. Residents, on the other hand, perceived the duration to be a mean of 2.50 hours per day as a PGY-1 resident that progressively decreased to an average of 0.75 hours per day as a PGY-5 resident.

Responses were obtained regarding the ideal importance of the items of (a) the percentage of time the teacher should spend in the operating room, (b) the percentage of contact time that the teacher should spend on teaching and learning, and (c) the number of hours actually spent per day on teaching and learning (Figure 16). Ideally, residents felt that faculty should spend a higher percentage of their time actually in the operating room with the resident at all stages of their training than that which they currently spend, especially in the PGY-1 year. Faculty felt that they currently spend about the correct amount of time with residents at all stages of their training. In fact, there was a trend for faculty to feel that they should spend a slightly lower percentage of time in the operating room with PGY-3, -4, and -5 residents than that which they are currently spending.

In terms of the percentage of the contact time spent on teaching, both faculty and residents agreed that to reach the ideal level, faculty should increase their percentage of engaged time on teaching with residents at all stages of their training than that which they currently are spending. Of note was the observation that the percentage of contact time to be spent on teaching and learning varied little over the five training levels. Furthermore, similar results were seen for the actual hours spent on teaching (in hours) per day in the operating room. Both faculty and residents agreed that faculty should spend more hours per day with the resident on teaching and learning than that which they currently are spending.

Thus, ideally, respondents felt that faculty should spend approximately 90%, 77%, 56%, 43%, and 27% of the time during the day actually in the operating room with

PGY-1, -2, -3, -4, and -5 residents respectively. Respondents felt that the teacher should spend approximately 45-55% of this contact time actually involved with the student on teaching and learning, no matter what training level of the student. Ideally, respondents felt that faculty should spend approximately 3.5, 3.0, 2.4, 1.9, and 1.5 hours per day engaging in teaching and learning with PGY-1, -2, -3, -4, and -5 residents respectively.

Reliability Analysis of Questionnaire Responses

Eight faculty and four resident respondents completed both the Q1 and Q2 questionnaires that each contained a number of identical questions. Thus, an interform reliability estimate could be made to determine if respondents answered consistently to the same questions over time. There were a total of 66 items in common between the two questionnaires. These items posed identical questions but were scored on different scales. As mentioned previously, items on the Q1 questionnaire were answered on a 4-point Likert-like scale while the Q2 questionnaire items were answered on a 5-point Likert-like scale. To check the reliability of respondents over these 66 items between the Q1 and Q2 questionnaire, the Q1 responses were transformed into an equivalent value on the 5-point scale (see Appendix D for the transformation procedures). For the eight faculty and four resident respondents, their individual Kendall W coefficient of concordance was calculated.

For faculty respondents, their average coefficient of concordance was 0.97 (range 0.94-0.99) and was statistically significant in all cases ($p<0.0001$). For resident respondents, their average coefficient of concordance was 0.95 (range 0.92-0.97) and was statistically significant in all cases ($p<0.001$). Thus, there was a very high degree of reliability over time between responses on matching questions on the Q1 and Q2 questionnaires for those respondents who completed both questionnaires. It is for this

reason that Q1 responses were included in the final analysis for those respondents who only completed the Q1 questionnaire.

In addition to an interform reliability estimate, an intraform reliability estimate may be made for responses to the Q2 questionnaire. There were two questions on the Q2 questionnaire that were repeated in identical form later in the questionnaire (questions 4d-25b and 4e-26b). This would determine if respondents answered consistently to the same question during the completion of the Q2 questionnaire.

The Spearman correlation coefficient for the first question set pair (questions 4d-25b) was 0.17 for faculty and -0.095 for residents. These values did not reach statistical significance (p=0.35 and p=0.82 respectively). For the second question set pair (questions 4e-26b), the Spearman correlation coefficient was 0.33 for faculty and 0.75 for residents. These values were very close to the level of statistical significance (p=0.061 and p=0.034 respectively). Thus, there was poor reliability of responses to identical questions repeated within the Q2 questionnaire.

CHAPTER SEVEN: DISCUSSION

As stated in Chapter 4, identification and ranking of the important factors involved in anaesthesia education in the operating room were the objectives of this thesis. Thus, as a descriptive study the delineation of these factors, and the forces promoting or inhibiting each, has been presented in the Results chapter. However, several comments may be made regarding the results obtained.

Before proceeding, it must be emphasized that the findings of this thesis were based upon the opinions, beliefs, and attitudes of the students and teachers involved in this educational system. As such, these perceptions may or may not be entirely accurate as a true reflection upon reality. Follow-up studies will need to confirm the precision of these perceptions before or during the implementation of any modifications to the instructional design of this educational system. However, despite this restriction, this thesis does delineate several areas where alteration of educational methodology may prove to be beneficial.

Theme 1. The Causal Influences on School Classroom Learning

Walberg's (1983) model of the causal influences on student learning illustrated the main factors that affect school classroom learning (Figure 1). However, it did not specify the relative importance of each of the factors. Subsequent work by Wang et al. (1993, 1994) does provide insight as to the relative influence of 28 factors on learning (Table 7). However, these factors and their relative influences are related to school classroom learning for children in grade school.

This thesis specifically addressed the issue of the relative influences of factors on learning outcomes for students in the special context of a postgraduate anaesthesia residency programme. It was found that student motivation and capability as well as

Table 7.

Relative Influences on School Classroom Learning.

Factor	Score	Factor	Score
1. Classroom management	64.8	15. Classroom assessment	50.4
2. Metacognitive processes	63.0	16. Community influences	49.0
3. Cognitive processes	61.3	17. Psychomotor skills	48.9
4. Home environment / Parental support	58.4	18. Teacher / administrator decision making	48.4
5. Student / teacher social interactions	56.7	19. Curriculum and instruction	47.7
6. Social / Behavioral attributes	55.2	20. Parental involvement policy	45.8
7. Motivational attributes	54.8	21. Classroom implementation / support	45.7
8. Peer group	53.9	22. Student demographics	44.8
9. Quantity of instruction	53.7	23. Out-of-class time	44.3
10. School culture	53.3	24. Program demographics	42.8
11. Classroom culture	52.3	25. School demographics	41.4
12. Classroom instruction	52.1	26. State-level policies	37.0
13. Curriculum design	51.3	27. School policies	36.5
14. Academic interactions	50.9	28. District demographics	32.9

instructional quality were perceived to be the most influential factors on student learning (Figure 7). It is not surprising that some factors that were found to be of great influence on school classroom learning were not found to be of similar influence for anaesthesia education. The contextual difference between these two learning settings and the underlying difference between the characteristics of the learners in these two learning situations may account for the differences observed.

For example, appropriate classroom management by the teacher and adequate metacognitive skills of the student greatly influence school classroom learning. However, those individuals partaking in anaesthesia education already have well-developed intrinsic attributes and skills for learning that do not necessitate teachers in securing a well-managed classroom in order to promote favorable student learning outcomes. These mature adult learners behave well in class and thus classroom management does not appear as a major influence upon learning for this group of learners. Likewise, through their many years of schooling, these advanced learners have well-developed metacognitive learning abilities.

However, the influence of motivational affective attributes is common to both sets of learners in the two different learning contexts. For pedagogical learners in school classroom situations, this ranks seventh in overall importance whereas it ranks first for andragogical learners in anaesthesia education. Thus, when comparing the factors of influence upon learning in different educational systems, the influential factors may be similar in type but the relative importances may differ depending on the nature of the context of learning and characteristics of the learners involved. Additionally, the nature of the facilitator, content, and educational programme also may impact upon these relative importances.

For Theme 1 questions it appears that faculty rated more highly than residents, the important influence of resident motivation on learning outcome. Likewise, it was seen

that residents rated more highly than faculty, the important influences of instructional quality and quantity on learning outcome. These results parallel the overall observation that faculty and residents seem to place greater weight for the influence on learning on the opposite party, rather than on themselves. Students appear to place the importance for their own learning on their teacher while teachers appear to place the importance for their students' learning on their students. Further discussion of this observation will follow in the subsequent Overall Important Factors section.

As well, it may be seen that no single factor accounts for the sole influence upon student learning. There are a multitude of influential factors that combine and trade-off. Walberg's list of nine main factors (Figure 1) has led to the development of the 28 factors outlined by Wang et al. (1993, 1994) as listed in Table 7. Many factors influence learning to a moderate extent. This has been observed for school classroom learning and has been repeated for anaesthesia education in the operating room. Most of the items on the Q2 questionnaire received mean scores greater than three on the 5-point scale, thus being *moderately* important.

Unfortunately, the situation may not be as simple as a few main factors, even if the list is extensive. The list of 28 main factors reported by Wang et al. (1993, 1994) was developed from 228 different variables. It has been suggested that the interaction of these main factors may also need to be taken into account. Hedges & Waddington (1993) state that

> while the vastly oversimplified Wang et al. model may be suitable for informing the task of picking the one most powerful influence on outcome, it is not suited to inform policy questions where all other variables cannot be held constant or where one wishes to modify several variables at once. To use their approach with 228 variables is to neglect some 4.3×10^{68} possible interactions. (pp. 345-6)

However, knowledge of the main factors (and their interactions) involved in school learning or anaesthesia education is indeed of use and advantage, even if the interaction

of these factors has not been clearly delineated. Once the important influences on learning are known, efforts at ensuring the maximal condition of these factors may be done in order to promote the most profitable learning outcome for students.

Theme 2. Adult Learning Principles

In this thesis, there was general agreement by respondents that adult learning principles are of importance for anaesthesia education in the operating room. James (1983) identified nine basic principles of adult learning that underlie adult education programs (Table 1). In addition, he compared the rankings of these nine principles across five different adult education programs in the settings of (a) university extension, (b) community college, (c) business and industry, (d) hospital patient education, and (e) agricultural extension. It was found that no two of the five settings had exactly the same rank ordering of the nine principles but four of the five settings held the same top principle (Principle 9: a comfortable learning environment). All of the nine principles were deemed to be *sometimes* to *frequently* applicable to each of the five settings.

For this study of anaesthesia education in the operating room, there was general agreement by respondents that adult learning principles are of importance. A ranking of the importances of adult learning principles in this context of learning was determined (Figure 8). Active student participation and experiential learning were perceived as important principles as well as the notion of the student moving from dependency to independency. Additionally, residents placed importance on a supportive learning environment, even more so than teachers.

Each of the five different educational contexts as described by James (1983) and that of anaesthesia education in the operating room agree as to the applicability of adult learning principles. However, the relative importance of each of the nine principles does vary depending on the specific circumstances and exact setting or context of the adult

education programme. Some adult education principles are of greater importance and impact depending of the particular nature of the students, teachers, the student-teacher interactions, content to be learned, and the environment and context in which the learning occurs. No one adult education principle predominates across all contexts of adult learning, just as no one principle of pedagogy predominates across all contexts of childhood learning.

Theme 3. Cognitive Apprenticeship Methodology

General support was found for the cognitive apprenticeship model as a descriptor of anaesthesia education in the operating room. However, this model does not exactly describe all the educational process that are currently occurring, nor all the process that should be occurring. There is something more to anaesthesia education in the operating room than that of an apprenticeship programme.

As the Q1 questionnaire results indicate, some apprenticeship principles follow well and do describe what should be done. Modeling, coaching, articulating, and scaffolding are important roles for the teacher while students observe, approximate, reflect, and practice. Gradually the support of the teacher fades as the proficiency of the student increases. Application of this model to teaching and learning processes for anaesthesia residents in the operating room is an area that deserves further study. Ideal levels of graduated responsibility (scaffolding) may be difficult to establish, yet are an important component of apprenticeship training for the anaesthesia resident. The generalizability of concepts learned in specific circumstances may need to be further emphasized by teachers to students. The harsh learning environment of the operating room was seen as a restrictive influence to some of the educational principles behind the cognitive apprenticeship model.

As determined in this thesis, other factors, such as faculty and student motivation, appear to be more influential than apprenticeship methodology for student learning outcomes. Certainly, the mechanics of apprenticeship training are in common with anaesthesia training in the operating room. However, there are other mechanics of the learning encounter that also impact upon teaching and learning.

Theme 4. The Mechanics of the Learning Encounter

A number of recommendations and conclusions may be drawn from the beliefs and opinions of the respondents to the questions pertaining to the mechanics of the learning encounter between the anaesthesia resident and the faculty anaesthetist in the operating room. Based upon the perceptions of the respondents in this survey, a suggested prescription for the daily instructional events may be proposed. These events are now listed chronologically following the preinstruction, during instruction, and postinstruction model.

Students should try to take more responsibility in making their needs known to the teacher and in deciding on the learning activity for the next day. Teachers likewise should try to consider the needs and wants of the particular resident. Perhaps this decision regarding the day's learning activity should take place preferably the night before the learning interaction. Thus, both the teacher and the student may prepare for this learning encounter.

It is essential that anaesthesia residents learn how to give anaesthetics in the operating room. The main benefit of teaching and learning in the operating room appears to be for the learning of skill items. Additionally, there appears to be sufficient time during Phase II moments for the teaching of knowledge items. The lower importance placed on the learning of knowledge items compared to the skill items is perhaps twofold. A great advantage of learning skill items in the operating room may be its context to the

real-life situation. Knowledge items also may be taught in other settings, perhaps even more efficiently, such as in the classroom setting. The learning of attitudinal items also may take place in the operating room setting.

The topic of learning chosen should try to relate to the cases being performed on that day in the operating room. Students and teachers should try to pose questions to each other in equal frequency. Perhaps students need to take more responsibility in this matter while teachers need to promote a comfortable environment for the student to do so.

The operating room, while being an imperative context for anaesthesia education, is perceived as a negative influence on teaching and learning nonetheless. There are many factors that impinge upon the educational interactions between students and teachers in this harsh learning environment. Students and teachers should try to be cognizant of this negative influence on their teaching and learning interactions and should try to devise methods to overcome these limitations and distractions. Thus, hands-on learning of manual skills or real-life cognitive skills may take place while accomplishing a task (Phase I). Discussions of items from the knowledge domain may be scheduled during quiet (Phase II) moments. All teaching and learning must be secondary to sound patient care. Other times may be available for teaching and learning during the day, including between cases (Phase III) as well as at the start or end of the day (Phase IV), but these times appear to be of lesser importance.

Quantity and quality of teaching is important. Quality may be more important overall, but quantity may be important especially to the junior resident or novice. Perhaps teachers need to spend more time in the operating room with the resident and spend more of this contact time actually on teaching and learning. Students, however, should try to be given the graded responsibility of "independent" practice with appropriate supervision. This correlates well with the apprenticeship model of teaching and learning.

Over the course of the five year residency, teachers should try to start by spending an average of approximately 90% of the time in the operating room with a resident in their first year of training. This may progressively decrease over the next four years to approximately one-third of the total time as direct contact time with residents in their most senior year of training. However, 45-55% of the contact time should be spent on teaching and learning interactions, no matter what the level of training of the resident.

Teachers appear to need and want to learn how to teach properly. Few currently have formal training in such but do recognize its importance. The teacher's individual teaching style does appear to impact upon the student's learning. Residents do appear to value a daily review of the day's learning encounter and desire feedback on their performance.

As outlined above, these suggested prescriptive modifications comprise several different mechanisms for the teaching and learning processes of the anaesthesia resident in the operating room. Thus, a number of alterations may be attempted to effect enhanced student learning. However, since these prescriptive changes are only based upon the perceptions of students and teacher, any new educational implementation must be monitored and evaluated for its possible positive or negative effects.

Overall Important Factors

As noted from the responses to Theme 1 questions, students appear to place the importance for their own learning on their teacher while teachers appear to place the importance for their students' learning on their students. These opinions were repeated when categorizing the weighted responses of the overall important factors to the categories of the Comprehensive Model of Teaching and Learning (Figure 13). Examination of the possible reasoning behind this observation will now follow.

Such opinions may not be surprising for school learning, especially on the part of the student. A great deal of authority and control for pedagogical learners is placed on their teachers. On the other hand, one may not expect necessarily such opinions from students and teachers involved in a truly adult education programme. However, these beliefs do appear to prevail even in a postgraduate medical educational programme. The issue is raised as to whether it is the absolute age of the student that defines andragogy. To a certain extent, the age of the student does influence andragogical practice and principles. However, the degree to which the student is a novice in the field of study also may be of influence.

Perhaps the reason mature adult students place great importance on their teachers for their own learning relates to the fact that they are, at times, novices undertaking the learning of new conceptual items with which they have little familiarity or previous linkages (Benner, 1982, 1984). Novice learners, whether they be pedagogical or andragogical learners, may require the external support and scaffolding of a facilitator by which to learn most effectively (Grow, 1991; Schon, 1983, 1991). Students realize this fact and thus, desire and pursue such assistance in order to learn most efficiently.

In contrast, we see teachers of adult students placing emphasis upon the student as masters of their own learning. Automatically, adult learners are assumed to be entirely self-directed and self-sufficient for all of their learning needs. Nevertheless, teachers must realize that when learners, whether they be adult learners or not, approach novel learning contexts or situations, they truly may benefit from the skilled guidance and facilitation of a teacher. This does not mean that the entire responsibility for the student's learning rests on the shoulders of the teacher, but that teachers still possess some degree of duty towards the student's education, even if the student is an adult learner.

Thus, adult learners attempting to learn a novel concept may choose pedagogical (over andragogical) methods in order to effect the most profitable learning outcomes for

themselves in the most efficient manner. This may explain the importance of the teacher on student learning outcomes from the standpoint of the adult learner. As seen from the standpoint of the teacher, the importance of the adult learner themselves on their own learning is a result of the teacher's assumption of the inherent self-directedness and characteristic self-reliability of the adult learner.

Of note was the fact that the adult learners in this study did indicate their understanding of the importance of their responsibility for their own learning. Resident respondents did acknowledge that residents should attempt to take greater control and leadership in the choosing of the next day's learning topic and in posing questions to their teachers. Perhaps teachers, who are always viewed in a position of greater power, need to assist these adult learners in diminishing this power differential and encourage students towards self-directed learning. Teachers may view a student's question as a mere desire to be spoon-fed information, rather than as an invitation to begin a discussion. Yet, even adult learners in novel areas of learning may require some degree of spoonfeeding, from time to time, to initiate and direct their learning.

Anaesthesia residents may be learners in transition between pedagogy and andragogy. They may display basically andragogical learner characteristics but may revert to pedagogical characteristics when confronted with a novel concept to master. These varying characteristics of the anaesthesia resident make the facilitation of their learning even more challenging than that for a purely pedagogical or andragogical learner (Delahaye, Limerick, & Hearn, 1994).

Unfortunately, anaesthesia educators appear to lack formal training in teaching. This presents a problem when teachers are required to confer metacognitive skills on their students when they themselves lack this requisite knowledge. Fortunately, anaesthesia educators appear aware of their weaknesses as teachers and do exhibit the desire to become better informed of effective teaching methods.

The benefit of a common rating scale across all Q2 questions allowed for the ranking of all factors across all four thematic areas. Faculty and resident respondents showed similar rankings of items. Both groups agreed on those factors that they believed were of importance for teaching and learning in the operating room.

Also of interest was the observation that almost all of the 51 items across all four thematic areas received ratings of importance between 3 and 5 on the 5-point scale. Thus, a wide variety of factors are perceived to be influential in the teaching and learning processes for anaesthesia education in the operating room. Certain factors are of greater importance than others, but there does not seem to exist a certain few factors that are solely responsible for profitable learning outcomes in this context. The corollary is that learning may not be profoundly improved by enhancing a few main factors. There is not one item or factor that is the magic bullet for operating room teaching, including a specific teaching method. Teaching and learning is a very complex endeavor with many factors involved together, including their interrelated and simultaneous interactions.

Student learning may not undergo a metamorphosis with a single change, but multiple modifications nonetheless may prove to enhance student learning. Fortunately, this thesis has identified several simple, inexpensive, and easily implemented alterations that may enrich anaesthesia education in the operating room.

Differences Between Current and Optimal Educational Practices

Students currently perceive that their teachers complete the necessary educational practices less frequently than that perceived by their teacher counterparts. Additionally, students perceive that the gap between current and ideal educational practices is larger than that perceived by their teacher counterparts. This is not surprising and probably students and teachers will always have these perceptions. Even so, teachers must always strive to be better to lessen this gap.

This thesis has clearly identified the major areas of concern to which attention must be placed in the future to effect improvements in the anaesthesia residency programme at The University of Calgary. This is true for the areas furthest from the perceived ideal and for those areas perceived of greatest importance and influence on teaching and learning. As well, the forces perceived as inhibiting the ideal have been delineated. This clear view will allow for the development of appropriate strategies for overall improvement in this anaesthesia residency programme.

Corroboration with the Previous Work of Paget, Lambert, and Eaton

There was general verification in this thesis of the previous work done by Paget, Lambert, and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976) regarding anaesthesia education in the operating room. In addition, several advances have been made. There has been an expansion to four over the previously defined two phases of learning for anaesthesia education in the operating room setting.

Additionally, this thesis has defined the relationship of teacher contact time and engaged teaching time in terms of the seniority of the anaesthesia resident. This has allowed the first window on the actual real-life practices of graded responsibility for the anaesthesia trainee. However, it is cautioned that the responses in this thesis are the subjective opinions of students and teachers. Subsequent observational alpha press studies will need to confirm these subjective opinions as reality. Even so, there was close agreement between faculty and resident respondents regarding teacher contact time and engaged teaching time across each of the five years of residency training.

Building upon the previous work of Paget, Lambert, and Eaton (Lambert & Paget, 1976; Paget & Eaton, 1977; Paget & Lambert, 1976), this thesis has greatly expanded upon the important mechanics of the learning encounter that promote effective teaching and learning interactions in the operating room. In addition to the effects of face-to-face

orientations, face masks, the need for quietness, and the necessity for vigilant patient monitoring, this thesis has described other important mechanics and mechanisms involved in operating room teaching. However, further work will need to be done to more clearly define those teaching and learning activities that will most greatly ensure profitable learning, especially effective methods of teaching.

Reliability

Reliability analysis revealed that interform responses were stable over time, thus indicating good reliability. However, intraform reliability analysis of the Q2 questionnaire did not confirm reliability. A cause for this may be due to the different contexts in which each of the two paired questions was asked. The two repeated questions that were analyzed for intraform reliability were initially posed within the context of Theme 1 (student classroom learning) and then repeated within the context of Theme 4 (mechanics of the learning encounter). Thus, respondents actually may have been answering two different question in their own mind, despite the identical textual format of the question. The contextual differences in which the two questions were posed may have given rise to different interpretations by respondents.

In fact, it has been found that the interpretation of a particular question by respondents is affected by the surrounding questions. As stated by Ayidiya and McClendon (1990), "numerous experiments have . . . shown that responses to survey questions can be significantly affected by the form and order in which they are presented to respondents" (p. 229). As well, response variation has been shown to be affected by question order effects (Benton & Daly, 1991; Dijkstra & van der Zouwen, 1982).

Respondents did vary their responses to "identical" questions positioned at different places within the same questionnaire. However, while these questions appeared "identical" in textual form, they may have been interpreted differently because of the two

different sections and contexts in which they were posed. Thus, intraform reliability truly may have been higher than that actually calculated.

Validity

In terms of content validity, this thesis considered a wide variety of factors that were drawn from an extensive review of the literature from many perspectives including school classroom learning, adult learning, and apprenticeship training. The Comprehensive Model of Teaching and Learning (Figure 4) was devised in order to ensure that consideration was made for each of the important components that influence teaching and learning in any situation. Additionally, the numerous open-ended questions on the Q1 questionnaire allowed respondents the opportunity for identifying important factors that may have been outside the initial scope of the investigation. As well, the Q2 questionnaire included open response options so that respondents could offer their opinions as to the overall important factors to be considered. The fact that no respondent chose to add an open response to the listing of categories in question 38 also may support a comprehensive scope.

To further support the validity of this thesis was the observation that its findings are in concordance with a major review of the factors important to school classroom learning. In their comprehensive examination, Wang et al. (1993) concluded that

> direct determinants of learning are operationalized using proximal variables, those variables which have an immediate effect on students. Student aptitudes and classroom practices are examples of proximal variables. Indirect determinants of learning are operationalized using distal variables which are one or more steps removed from students' day-to-day lives. State and district policies and demographics are examples of distal variables. . . . [Our] results demonstrated that proximal variables exert more influence than distal variables on school learning. (pp. 268 & 271)

The examination of the nature of anaesthesia education in the operating room similarly found that proximal variables; such as the characteristics of the student, teacher, and the student-teacher interaction; accounted for the majority of important influences on teaching and learning in this particular context (Figure 13). Distal variables, such as the micro- and macro-environments, are of importance, but to a lesser degree.

Furthermore, no single factor or small group of factors was found to be singularly responsible for anaesthesia education in the operating room. This finding likewise was observed for student learning in the classroom situation (Wang et al., 1993, 1994). For both of these educational contexts, a variety and multiplicity of factors were found to influence student learning outcomes.

Moreover, to further support criterion validity, the observation that one factor may effect its influence by means of another variable is noted for both anaesthesia education in the operating room and school classroom learning. For example, Q2 questionnaire respondents indicated the effects of recent healthcare reform (a distal variable) on faculty motivation to teach (a proximal variable). In this example, the increased stress and workload as a result of recent healthcare reforms was felt to be a significant component of the decline in motivation by both students and teachers in teaching and learning. The 22 categories of factors were not found to be mutually exclusive, but rather interrelated. This finding was similarly observed for school classroom learning. In their study, Wang et al. (1993) concluded that "distal policies are likely to make a major difference in learning . . . when they affect proximal practices" (p. 279).

Further research will be required to prove the predictive validity of this thesis. For example, predictive validity will be shown if anaesthesia residency programmes with a high degree of faculty and student motivation have superior student learning outcomes as compared with programmes having poor morale. However, it does appear that faculty motivation to teach is an important and desirable characteristic to be exhibited by

teachers in anaesthesia (Rhoton & Cascorbi, 1985) and medical education in general (Harth, Bavanandan, Thomas, Lai, & Thong, 1992; Irby, 1978; McLeod & Hardin, 1985; McLeod, James, & Abrahamowicz, 1993; Price & Mitchell, 1993; Sloan, Donnelly, & Schwartz, 1996).

Generalizability

In terms of generalizability, the adequate response rate to the questionnaire makes the results definitely applicable to The University of Calgary anaesthesia residency programme. Opinions gathered from 72% of respondents in The University of Calgary programme allows for an accurate representation of local beliefs and attitudes. Nevertheless, nonresponders may hold alternate views. Nonresponse bias may affect the conclusions reached by a survey (Pearl & Fairley, 1985). However, Smith (1983) simply states that "nonresponse bias is very difficult to assess accurately and no simple, certain method exists" (p. 386).

Generalizability to anaesthesia programmes outside of The University of Calgary is more guarded. Specific findings may not be applicable to other centres. Further study using the Q2 questionnaire given to faculty and residents in anaesthesia programmes at other Canadian universities, or even those in other countries, may corroborate the findings of this thesis to anaesthesia residency training as a whole. Such studies may confirm the importance of such factors as faculty and resident motivation on teaching and learning in the operating room.

In fact, the Q2 questionnaire may be modified for its application to other subspecialty medical residency training programmes. In such a way, one could determine those factors that generally influence postgraduate medical education. By comparing the results of this thesis to the work done on school classroom learning, it would seem probable that similar factors of influence would be found, but that their relative

importances may be different depending on the special context, circumstances, or situations of the particular educational programme. Overall, one may predict safely that proximal variables will be of greater importance than distal variables for most educational programmes.

Survey Research Methods

Several comments regarding survey research methods may be made. It is always challenging when developing a new questionnaire. The researcher relies on the evidence in the literature upon which to develop the individual questions to be included in the instrument. In this thesis, the most valuable section of the Q1 and Q2 questionnaires was that of the initial and final question where respondents could specify, in an open-ended fashion, their opinions as to the factors of greatest importance to anaesthesia education in the operating room. Open-ended questions completely remove the biases of the instrument developer. While such questions are harder for respondents to complete and for researchers to code and interpret, the quality of information received is definitely superior. If such a method had not been taken in this survey, the importance of faculty and resident motivation inadvertently may have been lessened.

Controversy exists regarding the inclusion of a middle response and a *don't know* alternative when using Likert-like scales (Babbie, 1990; Bishop, 1987; Converse & Presser, 1986; Dijkstra & van der Zouwen, 1982; Gilljam & Granberg, 1993). Converse & Presser (1986) reported that "it is not unusual for 20% of those interviewed to *choose* a middle alternative when it is offered although they would not *volunteer* it if it were not mentioned" (p. 36). As well, one-eighth to one-third of respondents will choose the *don't know* alternative when it is offered to them (Converse & Presser, 1986).

Despite detailed instructions for respondents to circle a single response to the 4-point Likert-like scale on the Q1 questionnaire, 14.2% of faculty and 22.6% of resident

responses were circled in the imaginary space between two alternatives. Additionally, faculty and resident respondents simply left some 1.9% of questions blank, thus indicating a lack of opinion, an equivalent *don't know* response, or merely the fact that they missed the question. When specifically offered on the Q2 questionnaire, respondents did choose the middle response and *don't know* alternatives. For the Q2 questionnaire, 21.4% of faculty and 27.3% of resident responses were that of the middle response alternative (3 on the 5-point scale). In addition, 2.4% of faculty and 1.3% of resident responses were to the *don't know* alternative. Thus, these observations are in keeping with the literature on the middle response. However, respondents in this thesis appeared to display great certainty regarding their opinions as determined by their low rate of response to the *don't know* alternative.

Since the Q1 and Q2 questionnaires were lengthy, an area of concern that may be raised is the effect of the questionnaire length on response quality. In a study by Sharp and Frankel (1983), instrument length was the only factor found to be linked to the perception of burden by survey respondents. However, counterbalancing this effect was the belief by respondents in the usefulness of the survey. Thus, the perceived usefulness of this study for anaesthesia education may have offset the negative effects of respondent burden related to the length of the Q1 and Q2 questionnaires.

As stated by Herzog and Bachman (1981),

> many researchers are convinced that survey instruments have a maximum length beyond which there is an increasing probability of premature termination, random responding, or other behavior patterns which result in data of lower quality. (p. 549)

However, these researchers found that the responses of high school students to a short (45 minute) and long (2 hour) form of questionnaire revealed little evidence of such effects. The one particular effect of increasing questionnaire length identified was that of "straight-line" responding near the end of the questionnaire, especially for items of

apparently lower intrinsic interest to the respondents. In fact, the majority of these "straight-line" responses employed the non-committal *neutral* response.

In this thesis, an increasing incidence in "straight-line" response patterns and *neutral* responses was not observed in the latter parts of the Q1 or Q2 questionnaires. While there appeared to be a continual variation of responses, however, random responding could not be ruled out. Perhaps the lack of "straight-line" and *neutral* response patterns was due to the design where respondents were allowed a prolonged period of time to complete the lengthy questionnaires, with the ability to complete parts of the questionnaire at different times.

Additionally, the high response rate attained in this study, even despite the lengthy questionnaires, is probably indicative of the high degree of importance and interest that respondents placed upon the topic of this research project. This high value placed upon this study may infer a reasonable degree of accuracy of all responses throughout the entire length of the questionnaires. Highly accurate responses may be presupposed from highly motivated respondents. Herzog and Bachman (1981) state that "to the extent that a topic is of interest to the respondent, he or she may overcome low motivation [to complete a long questionnaire] and respond more accurately" (p. 558). As Herzog and Bachman (1981) conclude,

> it appears that even a surprisingly long questionnaire can be administered without large-scale and pervasive deterioration of the quality of the data, particularly if efforts are made to maintain respondent motivation. (p. 559)

Thus, response quality may be assumed to be adequate for responses obtained by the questionnaire instruments used in this thesis.

In fact, the response rate as achieved in this study may not be surprising at all. Dillman (1978) reported similar response rates for studies using questionnaires of equal or greater length, or numbers of items, than that used in this study. This was especially true for those studies employing his total design method for mail surveys. Dillman's total

design method was not used to the full extent in this thesis, as he employs three follow-ups to the initial mailing. Nonetheless, a comparable response rate was achieved in this thesis using only a single follow-up mailing to nonresponders.

Another concern regarding the methodology of this thesis was the use of multiple ratings of individual categories to establish a ranking of the same categories. Rankings over multiple categories is a difficult task for respondents. As was seen by the numerous incorrectly completed responses for question 38 in the Q2 questionnaire, respondents indeed have difficulty doing such tasks. However, research by Alwin and Krosnick (1985) led them to conclude that "ratings and rankings [produce] similar results in terms of ordering the relative importance of value choices" (p. 548). Thus, it appears that ranking categories based upon multiple ratings of the individual categories is, in fact, a valid approach.

The Complexity of Teaching and Learning

A final reflection on teaching and learning now will be undertaken. This thesis has determined that the nature of anaesthesia education in the operating room is indeed complex. A variety of factors and interactions operate during teaching and learning encounters between faculty and resident anaesthetists. This parallels the situation for school classroom learning as seen by the multiple correlational path matrices, complex mathematical equations, and multi-level system designs that have been devised in an attempt to depict the association of a diverse number of factors and their interrelationships (Banathy, 1987; Bosker & Scheerens, 1994; Clauset & Gaynor, 1982; Cooley & Lohnes, 1976; Gagne, 1987; Parkerson, Lomax, Schiller, & Walberg, 1984; Reigeluth, 1983; & Walberg, 1981).

This consistent observation predicates that any improvements in educational design be aimed at multiple levels of the educational system (Bosker, Creemers, &

Scheerens, 1994; Purkey & Smith, 1982; Salisbury, 1993). As Banathy and Jenks (1993) suggest, this may involve changes at the learning experience level, the instructional level, the administrative level, or at the level of governance (policy-making).

The issue of complexity also predicts the unlikeness that a single teaching or learning method will prove to be a panacea for all learners, with every facilitator, for all topics, in all contexts of learning. Perhaps the essence of the art of teaching lies in the ability of the facilitator in developing a daily instructional design for each student, for each content topic, for the particular context in which their learning will occur (Clark & Peterson, 1986; Eisner, 1983; Lampert, 1985; Pierce, 1994; Pratt, 1989). Great skill is required for these "acts of improvisation" (Lampert, 1985, p. 185) whereby teachers make trade-offs and select appropriate factors and interactions to optimize in order to affect profitable learning.

Despite complexity, a collection of the "acts of improvisation" has been collated in this thesis from the perspective of the students and teachers involved in anaesthesia education in the operating room. As such, they have suggested not one, but several heuristics by which to improve the teaching and learning processes at a variety of system levels in this unique educational context.

CHAPTER EIGHT: CONCLUSIONS

This descriptive thesis, using standardized survey questionnaires, outlined in detail the opinions, beliefs, and attitudes from the perspective of both students and teachers regarding the factors of importance for anaesthesia residency education in the operating room at The University of Calgary. Areas that were explored included the factors that influence school classroom learning, adult learning principles, and cognitive apprenticeship methodology. Respondents to the survey identified those educational practices that promote student learning in terms of the mechanics of the learning encounter, elaborating upon the work of previous investigators. An expanded collection of influential factors on operating room teaching and learning has been documented. Influences interfering with current educational factors from being perceived as ideal have been identified. Subsequent observational studies will be required to confirm the perceptions of the respondents in this study as an accurate view of reality.

The Comprehensive Model of Teaching and Learning (Figure 4) assisted in the examination of this educational programme by depicting the major categories of important factors to consider. This included the factors central to the learning encounter including the characteristics of the learner, the facilitator, and the specific content to be learned. Other factors of importance included the microenvironment in which the learning encounter occurs and the more distant macroenvironmental conditions of the hierarchy and administrative policies of the learning institution. In concordance with school classroom learning, this thesis has determined that factors proximal to the student-teacher interaction are of greater importance and influence on student learning outcomes than that of more distal factors.

This thesis has established an extended, but not comprehensive, listing of the important factors that promote enhanced learning for the anaesthesia resident in the

operating room. Appropriate attention may now be placed on these various factors when undertaking any future programme improvement project, such as faculty development, or any prospective educational research. Motivation and willingness to teach and learn clearly have been documented as areas of great significance on learning for anaesthesia education in the operating room at The University of Calgary. Motivation and learning is certainly an area to further explore (see, for example, Ames & Ames, 1984; Boekaerts, 1988; Burke, 1995; Ericksen, 1984; Helmke, 1989; Lepper, 1983; Logan, 1970). Subsequent studies also may confirm these same factors to be of similar influence for anaesthesia residency programmes in general, or even for other medical subspecialty programmes.

The importance of teacher education in anaesthesia has been duly noted. Anaesthesia educators realize that they currently are deficient in the requisite knowledge and skills for effective teaching. However, to their benefit, they appear to sincerely desire the acquisition of such proficiencies.

Consistent with other educational research, this study of a postgraduate medical education programme has shown that teaching and learning processes are complex. Not only are a variety of factors involved, but intricate interrelationships between these factors have been shown to interact simultaneously. The assortment of influential factors may be the similar among distinct educational contexts, but the relative importances of these factors may differ. This relative ranking may be dependent upon the unique context specific to that particular educational programme. As well, any educational system is not entirely static, but rather in a constant state of flux. Thus, the pattern of important factors and influences may change with time.

Students and teachers tend to place responsibility on the other, on their counterpart, for student learning. Teachers assign great importance for student learning on the student, while students impart that responsibility to their teacher. This has been

seen even for the adult learners and their facilitators in this study. Thus, even the adult learner, who is a presumed self-directed learner, actually may adopt the attributes of a dependent pedagogical learner when encountering a novel item or field of study. It is for this reason that adult learners continue to indicate a high degree of reliance and importance upon their teachers by which to realize their own learning in an optimal and efficient fashion.

A clearer depiction of the nature of anaesthesia education in the operating room has emerged, albeit a complex one. It is hoped that this work will be of benefit to anaesthesia educators and medical educators in the future by providing a basis of understanding of the main determinants involved in teaching and learning processes upon which to build. Future studies will undoubtedly expand upon this basis for an even better comprehension. The quest has just begun in establishing effective schemes by which learners of anaesthesia may learn optimally.

REFERENCES

Allen, M.J., & Yen, W.M. (1979). Introduction to Measurement Theory. Monterey, CA: Brooks/Cole.

Alwin, D.F., & Krosnick, J.A. (1985). The measurement of values in surveys: A comparison of ratings and rankings. *Public Opinion Quarterly, 49*, 535-552.

Al-Shehri, A., Stanley, I., & Thomas, P. (1993). Continuing education for general practice. 2. Systematic learning from experience. *British Journal of General Practice, 43*, 249-253.

Ames, R., & Ames, C. (1984). *Research on motivation in education.* Orlando, FL: Academic Press.

Arends, R.I. (1993). *Learning to teach* (2nd ed.). New York: McGraw-Hill.

Ayidiya, S.A., & McClendon, M.J. (1990). Response effects in mail surveys. *Public Opinion Quarterly, 54*, 229-247.

Babbie, E. (1990). *Survey research methods* (2nd ed.). Belmont, CA: Wadsworth.

Banathy, B.H. (1987). Instructional systems design. In R.M. Gagne (Ed.), *Instructional technology: Foundations* (pp. 85-112). Hillsdale, NJ: Erlbaum.

Banathy, B.H., & Jenks, C.L. (1993). The transformation of education: By design. *International Journal of Educational Research, 19*, 105-115.

Barber, J.W. (1969). *Industrial training handbook.* New York: Barnes.

Baskett, H.K.M., Marsick, V.J., & Cervero, R.M. (1992). Putting theory to practice and practice to theory. In H.K.M. Baskett & V.J. Marsick (Eds.), *Professionals' ways of knowing: New findings on how to improve professional education* (New Directions for Adult and Continuing Education; vol. 55, pp. 109-118). San Francisco: Jossey-Bass.

Bass, B.M., & Vaughan, J.A. (1966). *Training in industry: The management of learning.* Belmont, CA: Wadsworth.

Basse, F.A. (1969). *Three-dimensional foremanship.* American Management Association.

Benner, P. (1982). From novice to expert. *American Journal of Nursing, 82*, 402-407.

Benner, P. (1984). *From novice to expert. Excellence and power in clinical nursing practice*. Menlo Park, CA: Addison-Wesley.

Benton, J.E., & Daly, J.L. (1991). A question order effect in a local government survey. *Public Opinion Quarterly, 55*, 640-642.

Berliner, D.C. (1982). Recognizing instructional variables. In D.E. Orlosky (Ed.), *Introduction to education* (pp. 198-225). Columbus, OH: Merrill.

Berry, A.J., & Hall, J.R. (1993). Work hours of residents in seven anesthesiology training programs. *Anesthesia and Analgesia, 76*, 96-101.

Beverstock, A.G. (1969). Apprenticeship training. In J.W. Barber (Ed.), *Industrial training handbook* (pp. 296-306). New York: Barnes.

Biggs, J.B., & Telfer, R. (1987). *The process of learning* (2nd ed.). Sydney, Australia: Prentice-Hall.

Bishop, G.F. (1987). Experiments with the middle response alternative in survey questions. *Public Opinion Quarterly, 51*, 220-232.

Blake, H.E., & McPherson, A.W. (1973). Individualized instruction. Where are we? In J.E. Duane (Ed.), *Individualized instruction - programs and materials* (pp. 13-14). Englewood Cliffs, NJ: Educational Technology Publications.

Boekaerts, M. (1988). Emotion, motivation and learning. International Journal of *Educational Research, 12*, 227-346.

Borg, W.R., & Gall, M.D. (1989). *Educational research. An introduction* (5th ed.). New York: Longman.

Bosker, R.J., & Scheerens, J. (1994). Alternative models of school effectiveness put to the test. *International Journal of Educational Research, 21*, 159-180.

Bosker, R.J., Creemers, B.P.M., & Scheerens, J. (1994). Conceptual and methodological advances in educational effectiveness research. *International Journal of Educational Research, 21*, 121-213.

Brookfield, S.D. (1986). *Understanding and facilitating adult learning*. San Francisco: Jossey-Bass.

Brookfield, S.D. (1992). Why can't I get this right? Myths and realities in facilitating adult learning. *Adult Learning, 3*(6), 12-15.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*, 32-42.

Bruce, D.L., & Bach, M.J. (1975). Psychological studies of human performance as affected by traces of enflurane and nitrous oxide. *Anesthesiology, 42*, 194-196.

Bruce, D.L., Bach, M.J., & Arbit, J. (1974). Trace anesthetic effects on perceptual, cognitive, and motor skills. *Anesthesiology, 40*, 453-458.

Burack, E.A., & Smith, R.D. (1982). *Personnel management. A human resource system approach* (pp. 526-530). New York: Wiley.

Burke, D.J. (1995). Connecting content and motivation: Education's missing link. *Peabody Journal of Education, 70*(2), 66-81.

Cantor, J.A. (1992). *Delivering instruction to adult learners*. Toronto, Canada: Wall & Emerson.

Cashman, J.N., Skelly, A.M., & Jones, H. (1989). Anesthesiology residents performance: Effect of a 24-hr on-call duty (abstract). *Anesthesiology, 71*, A921.

Clark, C.M., & Peterson, P.L. (1986). Teachers' thought processes. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd. ed., pp. 255-296). New York: Macmillan.

Clauset, K.H., & Gaynor, A.K. (1982). A systems perspective on effective schools. *Educational Leadership, 4*(3), 54-59.

Cognition and Technology Group at Vanderbilt (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher, 19*, 2-10.

Cohen, E.N. (1980). *Anesthetic exposure in the workplace*. Littleton, MA: PSG.

Collins, A., & Stevens, A.L. (1983). A cognitive theory of inquiry teaching. In C.M. Reigeluth (Ed.). *Instructional-design theories and models. An overview of their current status* (pp. 247-278). New Jersey: Lawrence Erlbaum.

Collins, A., Brown, J.S., & Holum, A. (1991). Cognitive Apprenticeship: Making thinking visible. *American Educator, 15*, 6-11 & 38-46.

Collins, A., Brown, J.S., & Newman, S.E. (1989). Cognitive apprenticeship: teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (Ed.), *Knowing, learning and instruction. Essays in honor of Robert Glaser* (pp. 453-494). New Jersey: Lawrence Erlbaum.

Cooley, W.W., & Lohnes, P.R. (1976). *Evaluation research in education.* New York: Wiley.

Connor, J.J. (1983). *On-the-job training.* Boston: International Human Resources Development Corporation.

Converse, J.M., & Presser, S. (1986). *Survey questions. Handcrafting the standardized questionnaire.* Beverly Hills, CA: Sage.

Cottrell, J.E. (1981). Occupational hazards to operating room and recovery room personnel. *International Anesthesiology Clinics, 19*(4), 1-176.

Cox, K.R., & Ewan, C.E. (1988). *The medical teacher.* New York: Churchill Livingstone.

Craig, R.L., & Bittel, L.R. (1967). *Training and Development Handbook.* New York: McGraw-Hill.

Cruickshank, D.R. (1990). *Research that informs teachers and teacher educators.* Bloomington, IN: Phi Delta Kappa.

Delahaye, B.L., Limerick, D.C., & Hearn, G. (1994). The relationship between andragogical and pedagogical orientations and the implications for adult learning. *Adult Education Quarterly, 44,* 187-200.

Dijkstra, W., & van der Zouwen, J. (1982). *Response behaviour in the survey-interview.* London: Academic Press.

Dillman, D.A. (1978). *Mail and telephone surveys: The total design method.* New York: Wiley.

Dreyfus, H.L., & Dreyfus, S.E. (1986). *Mind over machine.* New York: Free Press.

Drui, A.B., Bhem, R.J., & Martin, W.E. (1973). Predesign investigation of the anesthesia operational environment. *Anesthesia and Analgesia, 52,* 584-91.

Dunkin, M.J., & Biddle, B.J. (1974). *The study of teaching.* New York: Holt, Rinehart, & Winston.

Eagle, C.J. (1992). Anaesthesia and education. *Canadian Journal of Anaesthesia, 39,*158-165.

Eisner, E.W. (1983). The art and craft of teaching. *Educational Leadership, 40*(4), 4-13.

Ericksen, S.C. (1984). *The essence of good teaching.* San Francisco: Jossey-Bass.

Farmer, J.A., Buckmaster, A., & LeGrand, B. (1992). Cognitive apprenticeship: Implications for continuing professional education. In H.K.M. Baskett & V.J. Marsick (Eds.), *Professionals' ways of knowing: New findings on how to improve professional education* (New Directions for Adult and Continuing Education; vol. 55, pp. 41-49). San Francisco: Jossey-Bass.

Farmer, J.A., Lippert, F.G., & Schafer, M.F. (1992). Making orthopaedic education interactive, problem oriented, and on target. In R.E. Eilert (Ed.), *Instructional Course Lectures*, pp. 481-486. Park Ridge, IL: American Academy of Orthopaedic Surgeons.

Fowler, F.J. (1993). *Survey research methods* (2nd ed.). Newbury Park, CA: Sage.

Fraser, B.J. (1989). Twenty years of classroom climate work: Progress and prospect. *Journal of Curriculum Studies*, *21*, 307-327.

Fraser, B.J., Walberg, H.J., Welch, W.W., & Hattie, J.A. (1987a). Syntheses of educational productivity research: Chapter 2. Synthesis of research on factors influencing learning. *International Journal of Educational Research, 11*, 155-64.

Fraser, B.J., Walberg, H.J., Welch, W.W., Hattie, J.A. (1987b). Syntheses of educational productivity research: Chapter 4. Identifying the salient facets of a model of student learning: a synthesis of meta-analyses. *International Journal of Educational Research, 11*, 187-212.

Gaba, D.M., Herndon, O., Zornow, M., Weinger, M., & Dallen, L. (1991). Task analysis, vigilance, and workload in novice residents (abstract). *Anesthesiology, 75*, A1060.

Gaba, D.M., Howard, S.K., & Jump, B. (1994). Production pressure in the work environment. California anesthesiologists' attitudes and experiences (abstract). *Anesthesiology, 81*, 488-500.

Gaba, D.M., & Lee, T. (1990). Measuring the mental workload of the anesthesiologist (abstract). *Anesthesiology, 73*, A1027.

Gable, R.K. (1986). *Instrument development in the affective domain.* Boston: Kluwer-Nijhoff.

Gage, N.L. (1978). *The scientific basis of the art of teaching.* New York: Teachers College Press.

Gagne, R.M. (1987). *Instructional technology: Foundations.* Hillsdale, NJ: Erlbaum.

Gilljam, M., & Granberg, D. (1993). Should we take don't know for an answer? *Public Opinion Quarterly, 57*, 348-357.

Grow, G. O. (1991). Teaching learners to be self-directed. *Adult Education Quarterly, 41*, 125-149.

Haertel, G.D., Walberg, H.J., & Weinstein, T. (1983). Psychological models of educational performance: a theoretical synthesis of constructs. *Review of Educational Research, 53*, 75-91.

Harth, S.C., Bavanandan, S., Thomas, K.E., Lai, M.Y., & Thong, Y.H. (1992). The quality of student-teacher interactions in the clinical learning environment. *Medical Education, 26*, 321-326.

Hedges, L.V., & Waddington, T. (1993). From evidence to knowledge to policy: Research synthesis for policy formation. *Review of Educational Research, 63*, 345-352.

Helmke, A. (1989). Affective student characteristics and cognitive development: Problems, pitfalls, perspectives. *International Journal of Educational Research, 13*, 915-932.

Herzog, A.R, & Bachman, J.G. (1981). Effects of questionnaire length on response quality. *Public Opinion Quarterly, 45*, 549-559.

Hurst, J.W. (1992). *The bench and me. Teaching and learning in medicine.* New York: Igaku-Shoin.

Irby, D.M. (1978). Clinical teacher effectiveness in medicine. *Journal of Medical Education, 53*, 808-815.

Irby, D.M. (1992). How attending physicians make instructional decisions when conducting teaching rounds. *Academic Medicine, 67*, 630-638.

Irby, D.M. (1994). What clinical teachers in medicine need to know. *Academic Medicine, 69*, 333-342.

Irby, D.M. (1995). Teaching and learning in ambulatory care settings: A thematic review of the literature. *Academic Medicine, 70*, 898-931.

Jaeger, R.M. (1988). Survey research methods in education. In R.M. Jaeger (Ed.), *Complementary methods for research in education* (pp. 303-387). Washington, DC: American Educational Research Association.

James, W.B. (1983). An analysis of perceptions of the practices of adult educators from five different settings. *Proceedings of the Adult Education Research Conference* (no. 24, pp. 130-135). Montreal, Canada: Concordia University / University of Montreal.

Jarvis, P. (1992). Learning practical knowledge. In H.K.M. Baskett & V.J. Marsick (Eds.), *Professionals' ways of knowing: New findings on how to improve professional education* (New Directions for Adult and Continuing Education; vol. 55, pp. 89-96). San Francisco: Jossey-Bass.

Kam, P.C.A., Kam, A.C., & Thompson, J.F. (1994). Noise pollution in the anaesthetic and intensive care environment. *Anaesthesia, 49*, 982-986.

Knowles, M.S. (1978). *The adult learner: A neglected species*. Houston, TX: Gulf.

Knowles, M.S. (1987). Adult learning. In R.L. Craig (Ed.), *Training and Development Handbook*. New York: McGraw-Hill.

Kolb, D.A. (1984). *Experiential learning. Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

Lambert, T.F., & Paget, N.S. (1976). Teaching and learning in the operating theatre. *Anaesthesia and Intensive Care, 4*, 304-307.

Lampert, M. (1985). How do teachers manage to teach? Perspectives on problems in practice. *Harvard Educational Review, 55*, 178-194.

LeGrand Brandt, B., Farmer, J.A., & Buckmaster, A. (1993). Cognitive apprenticeship approach to helping adults learn. In D.D. Flannery (Ed.) *Applying cognitive learning theory to adult learning* (New Directions for Adult and Continuing Education; vol. 59, pp. 69-78). San Francisco: Jossey-Bass.

Lepper, M.R. (1983). Extrinsic reward and intrinsic motivation: Implications for the classroom. In J.M. Levine & M.C. Wang (Eds.), *Teacher and student perceptions: Implications for learning* (pp. 281-318). Hillsdale, NJ: Erlbaum.

Lichtor, J.L., Nuotto, E., Hendren, M., Lane, B.S., Dohrn, C., & Korttila, K. (1989). Driving home after on call: The effect of sleep deprivation on psychomotor performance and moods in anesthesia residents (abstract). *Anesthesiology, 71*, A922.

Lippert, F.G., & Farmer, J.A. (1984). *Psychomotor skills in orthopedic surgery.* Baltimore: Williams & Wilkins.

Loeb, R.G. (1994). Monitor surveillance and vigilance of anesthesia residents. *Anesthesiology, 80*, 527-533.

Logan, F.A. (1970). Fundamentals of learning and motivation. Dubuque, IA: Brown.

Lovin, B.K. (1992). Professional learning through workplace partnerships. In H.K.M. Baskett & V.J. Marsick (Eds.) *Professionals' ways of knowing: New findings on how to improve professional education* (New Directions for Adult and Continuing Education; vol. 55, pp. 61-69). San Francisco: Jossey-Bass.

Marjoribanks, K. (1994). Environmental press of families and schools. *International Journal of Educational Research, 21*, 439-555.

Marsick, V.J. (1987). *Learning in the workplace.* London: Croom Helm.

McCord, A.B. (1987). Job training. In R.L. Craig (Ed.). *Training and Development Handbook* (pp. 363-382). New York: McGraw-Hill.

McDonald, S., Spielman, F., Mayer, D., & Calhoun, P. (1994). A survey of anesthesiology residents regarding anxiety and methods of stress reduction during training (abstract). *Anesthesiology, 81*, A1233.

McIntyre, J.W.R. (1982). Man-machine interface: The position of the anaesthetic machine in the operating room. *Canadian Anaesthesia Society Journal, 29*, 74-8.

McLeod, P.J., & Harden, R.M. (1985). Clinical teaching strategies for physicians. *Medical Teacher, 7*, 173-189.

McLeod, P.J., James, C.A., & Abrahamowicz, M. (1993). Clinical tutor evaluation. *Medical Education, 27*, 48-54.

Merriam, S.B. (1993). *An update on adult learning theory* (New Directions for Adult and Continuing Education, vol. 57). San Francisco: Jossey-Bass.

Merriam, S.B., & Caffarella, R.S. (1991). *Learning in adulthood. A comprehensive guide.* San Francisco: Jossey-Bass.

Mitzel, H.E. (1960). Teacher effectiveness. In C.W. Harris (Ed.), *Encyclopedia of Educational Research* (3rd ed., pp. 1481-1486). New York: Macmillan.

Moore, D.T. (1986). Learning at work: Case studies in non-school education. *Anthropology and Education Quarterly, 17*, 166-184.

Moore, D.T. (1981). Discovering the pedagogy of experience. *Harvard Educational Review, 51*, 287-300.

Murthy, V.S.S.N., Malhotra, S.K., Bala, I., & Raghunathan, M. (1995). Detrimental effects of noise on anaesthetists. *Canadian Journal of Anaesthesia, 42*, 608-611.

Nahrwold, M. (1990). Hazards of the anesthesiologist's workplace. *American Society of Anesthesiologists Annual Refresher Course Lectures, 155*, 1-4.

Neighbor, R. (1992). *The inner apprentice. An awareness-centered approach to vocational training for general practice*. Dordrecht, The Netherlands: Kluwer Academic.

Nickse, R. (1981). *Competency-based education: beyond minimum competency testing*. New York: Teachers College Press.

Paget, N.S., & Lambert, T.F. (1976). Tutor-student interaction in the operating theatre. *Anaesthesia and Intensive Care, 4*, 301-303.

Paget, N.S., & Eaton, E. (1977). Teaching anaesthetics in the operating room. *Anaesthesia and Intensive Care, 5*, 247-250.

Parker, J.B.R. (1987). The effect of fatigue on physician performance - an underestimated cause of physician impairment and increased patient risk. *Canadian Journal of Anaesthesia, 34*, 489-495.

Parkerson, J.A., Lomax, R.G., Schiller, D.P., & Walberg, H.J. (1984). Exploring causal models of educational achievement. *Journal of Educational Psychology, 76*, 638-646.

Parsloe, M.R., & MacDonald, R. (1989). Obstetric anaesthetic workload in a teaching unit. *Anaesthesia, 44*, 252-253.

Pearl, D.K., & Fairley, D. (1985). Testing for the potential for nonresponse bias in sample surveys. *Public Opinion Quarterly, 49*, 553-560.

Pierce, C. (1994). Importance of classroom climate for at-risk learners. *Journal of Educational Research, 88*, 37-42.

Polk, S.L., Triplett, H.B., & Newman, L.M. (1988). Sources of stress in beginning anesthesia residents (abstract). *Anesthesiology, 69*, A793.

Porter, A.C., & Brophy, J. (1988). Synthesis of research on good teaching: Insights from the work of the Institute for Research on Teaching. *Educational Leadership, 45*(8), 74-85.

Pratt, D.D. (1981). Teacher effectiveness - Future directions for adult education. *Studies in Adult Education, 13*, 112-119.

Pratt, D.D. (1988). Andragogy as a relational construct. *Adult Education Quarterly, 38*, 160-181.

Pratt, D.D. (1989). Three stages of teacher competence: A developmental perspective. In E. Hayes (Ed.), *Effective teaching styles* (New Directions for Continuing Education; no. 43, pp. 77-87). San Francisco: Jossey-Bass.

Pratt, D.D. (1993). Andragogy after twenty-five years. In S.B. Merriam (Ed.), *An Update on Adult Learning Theory* (New Directions for Adult and Continuing Education; vol. 57, pp. 15-23). San Francisco: Jossey-Bass.

Price, D.A., & Mitchell, C.A. (1993). A model for clinical teaching and learning. *Medical Education, 27*, 62-68.

Prys-Roberts, C., Cooper, G.M., & Hutton, P. (1988). Anaesthesia in the undergraduate medical curriculum (Editorial). *British Journal of Anaesthesia, 60*, 354-357.

Purkey, S.C., & Smith, M.S. (1982). Too soon to cheer? Synthesis of research on effective schools. *Educational Leadership, 40*(3), 64-69.

Reigeluth, C.M. (1983). *Instructional-design theories and models: An overview of their current status*. Hillsdale, NJ: Erlbaum.

Resnick, L.B. (1987). Learning in school and out. *Educational Researcher, 16*, 13-20.

Rhoton, M.F., & Cascorbi, H.F. (1985). Good clinical teachers: What do/don't they do? (abstract). *Anesthesiology, 63*, A491.

Salisbury, D.F. (1993). Designing and implementing new models of schooling. *International Journal of Educational Research, 19*, 99-196.

Schon, D.A. (1983). *The reflective practitioner*. New York: Basic Books.

Schon, D.A. (1991). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.

Schwartz, A.J. (1990). Teaching in anesthesia. In R.D. Miller (Ed.), *Anesthesia* (3rd ed., pp. 2371-2380). New York: Churchill Livingstone.

Sharp, L.M., & Frankel, J. (1983). Respondent burden: A test of some common assumptions. *Public Opinion Quarterly, 47*, 36-53.

Shuell, T.J. (1990). Phases of meaningful learning. *Review of Educational Research, 60*, 531-547.

Shulman, L.S. (1986). Paradigms and research programs in the study of teaching: A contemporary perspective. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 3-36). New York: Macmillan.

Siegel, S., & Castellan, N.J. (1988). *Nonparametric statistics for the behavioral sciences* (2nd ed.). New York: McGraw-Hill.

Simon, R.I., Dippo, D., & Schenke, A. (1991). *Learning work. A critical pedagogy of work education* (pp. 57-72). Toronto, Canada: The Ontario Institute for Studies in Education.

Singer, E.J., & Macdonald, I.D. (1970). *Is apprenticeship outdated?* London: Institute of Personnel Management.

Sloan, D.A., Donnelly, M.B., & Schwartz, R.W. (1996). The surgical clerkship: Characteristics of the effective teacher. *Medical Education, 30*, 18-23.

Smith, T.W. (1983). The hidden 25 percent: An analysis of nonresponse on the 1980 general social survey. *Public Opinion Quarterly, 47*, 386-404.

Stokes, P.M. (1966). *Total job training.* New York: American Management Association.

Toung, T.J.K., Donham, R.T., & Rogers, M.C. (1985). Anesthesiology training and the stress of giving anesthesia (abstract). *Anesthesiology, 63*, A490.

Tweed, W.A., & Donen, N. (1994). The experiential curriculum: an alternate model for anaesthesia education. *Canadian Journal of Anaesthesia, 41*, 1227-1233.

Walberg, H.J. (1981). A psychological theory of educational productivity. In F.H. Farley & N. Gordon (Eds.), *Psychology and Education* (pp. 81-108). Berkeley, CA: McCutchan.

Walberg, H.J. (1984). Improving the productivity of America's schools. *Educational Leadership, 41*(8), 19-27.

Walberg, H.J. (1986). Synthesis of research on teaching. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 214-229). New York: Macmillan.

Wang, M.C., Haertel, G.D., & Walberg, H.J. (1990). What influences learning? A content analysis of research literature. *Journal of Educational Research, 84*, 30-43.

Wang, M.C., Haertel, G.D., & Walberg, H.J. (1993). Toward a knowledge base for school learning. *Review of Educational Research, 63*, 249-294.

Wang, M.C., Haertel, G.D., & Walberg, H.J. (1994). What helps students learn? *Educational Leadership, 51*(4), 74-79.

Waxman, H.C., & Walberg, H.J. (1991). *Effective teaching: Current research.* Berkeley, CA: McCutchan.

Webster, N. (1971). *The living Webster encyclopedic dictionary of the English language.* Chicago: The English Language Institute of America.

Wilkinson, R.T. (1974). Measuring the effects of environment upon performance. *Proceedings of the Royal Society of Medicine, 67*, 994-996.

Wilson, B., & Cole, P. (1991). Cognitive apprenticeship: An instructional design review. *Proceedings of selected research presentations at the annual convention of the association for educational communications and technology.* (ERIC Document Reproduction Service No. ED 335 022)

Wittrock, M.C. (1986). *Handbook of research on teaching* (3rd ed.). New York: Macmillan.

Woodward, C.A. (1988). Questionnaire construction and question writing for research in medical education. *Medical Education, 22*, 347-363.

Zelcer, J., Manton, J., & Paull, J.D. (1990). A controlled study on the cognitive and performance impacts of sleep deprivation in anaesthetic registrars (abstract). *Anesthesiology, 73*, A1065.

Zemke, R., & Zemke, S. (1988). Thirty things we know for sure about adult learning. *Training*, 57-61.

Appendix A.

References for the Comprehensive Model of Teaching and Learning.

Bennett, S.N. (1978). Recent research on teaching: A dream, a belief, and a model. *British Journal of Educational Psychology, 48*, 127-147.

Biddle, B.J. (1964). The integration of teacher effectiveness research. In B.J. Biddle & W.J. Ellena (Eds.), *Contemporary research on teacher effectiveness* (pp. 1-40). New York: Holt, Rinehart, & Winston.

Biggs, J.B., & Telfer, R. (1987). *The process of learning* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Bloom, B.S. (1976). *Human characteristics and school learning.* New York: McGraw-Hill.

Bosker, R.J., & Scheerens, J. (1994). Alternative models of school effectiveness put to the test. *International Journal of Educational Research, 21*, 159-180.

Brown, A.L., Campione, J.C., & Day, J.D. (1981). Learning to learn: On training students to learn from texts. *Educational Researcher, 10*(2), 14-21.

Bruner, J.S. (1966). *Toward a theory of instruction.* New York: Norton.

Burke, D.J. (1995). Connecting content and motivation: Education's missing link. *Peabody Journal of Education, 70*, 66-81.

Carroll, J.B. (1963). A model of school learning. *Teacher's College Record, 64*, 723-733.

Carroll, J.B. (1989). A 25-year retrospective and prospective view. *Educational Researcher, 18*(1), 26-31.

Centra, J.A., & Potter, D.A. (1980). School and teacher effects: An interrelational model. *Review of Educational Research, 50*, 273-291.

Cooley, W.W., & Lohnes, P.R. (1976). *Evaluation research in education.* New York: Wiley.

Cruickshank, D.R. (1984). Toward a model to guide inquiry in preservice teacher education. *Journal of Teacher Education, 35*, 43-48.

Cruickshank, D.R. (1990). *Research that informs teachers and teacher educators.* Bloomington, IN: Phi Delta Kappa.

Doyle, W. (1977). Paradigms for research on teacher effectiveness. In L.S. Shulman & S. Mowry (Eds.), *Review of Research in Education* (Vol. 5, pp. 163-198). Itasca, IL: Peacock.

Dunkin, M.J., & Biddle, B.J. (1974). *The study of teaching.* New York: Holt, Rinehart, & Winston.

Flanders, N.A. (1987). Human interaction models. In M.J. Dunkin (Ed.), *The international encyclopedia of teaching and teacher education* (pp. 20-28). Oxford, England: Pergamon Press.

Fraser, B.J., Walberg, H.J., Welch, W.W., & Hattie, J.A. (1987). Synthesis of educational productivity research. *International Journal of Educational Research, 11*, 145-252.

Glaser, R. (1976). Components of a psychology of instruction: Toward a science of design. *Review of Educational Research, 46*, 1-24.

Glaser, R. (1982). Instructional psychology: Past, present, and future. *American Psychologist, 37*, 292-305.

Grossman, P.L., & Stodolsky, S.S. (1994). Considerations of content and the circumstances of secondary school teaching. In L. Darling-Hammond (Ed.), *Review of Research in Education* (Vol. 20, pp. 179-221). Washington, DC: American Educational Research Association.

Haertel, G.D., Walberg, H.J., & Weinstein, T. (1983). The psychological models of educational performance: A theoretical synthesis of constructs. *Review of Educational Research, 53*, 75-91.

Harnischfeger, A., & Wiley, D.E. (1976). The teaching-learning process in elementary schools: A synoptic view. *Curriculum Inquiry, 6*, 5-43.

Jenkins, J.J. (1979). Four points to remember: A tetrahedral model of memory experiments. In L.S. Cermak & F.I.M. Craik (Eds.), *Levels of processing in human memory* (pp. 429-446). New York: Erlbaum.

Jones, B.F. (1992). Cognitive designs in instruction. In M.C. Alkin (Ed.), *Encyclopedia of educational research* (6th ed., pp. 166-178). New York: Macmillan.

Joyce, B., & Weil, M. (1972). *Models of teaching* (1st ed.). Englewood Cliffs, NJ: Prentice-Hall.

Majoribanks, K. (1994). Families, schools and children's learning: A study of children's learning environments. *International Journal of Educational Research, 21*, 439-555.

McDonald, F.J., & Elias, P.M. (1976). A report on the results of phase II of the beginning teacher evaluation study: An overview. *Journal of Teacher Education, 26*, 315-316.

Medley, D.M. (1982). Teacher effectiveness. In H. Mitzel (Ed.). *Encyclopedia of educational research* (5th ed., pp. 1894-1903). New York: Free Press.

Porter, A.C., & Brophy, J. (1988). Synthesis of research on good teaching: Insights from the work of the Institute for Research on Teaching. *Educational Leadership, 45*, 74-85.

Pratt, D.D. (1992). Conceptions of teaching. *Adult Education Quarterly, 42*, 203-220.

Reynolds, A. (1992). What is competent beginning teaching? A review of the literature. *Review of Educational Research, 62*, 1-35.

Reynolds, M.C., Wang, M.C., & Walberg, H.J. (1992). The knowledge bases for special and general education. *Remedial and Special Education, 13*(5), 6-10 & 33.

Scheerens, J. (1992). *Effective schooling: Research, theory, and practice*. London: Cassell.

Scheerens, J., & Creemers, B.P.M. (1989). Conceptualizing school effectiveness. *International Journal of Educational Research, 13*, 691-706.

Schwab, J.J. (1973). The Practical 3: Translation into curriculum. *School Review, 81*, 501-522.

Shulman, L.S. (1986). Paradigms and research programs in the study of teaching: A contemporary perspective. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 3-36). New York: Macmillan.

Siegel, L., & Siegel, L.C. (1967). A multivariate paradigm for educational research. *Psychological Bulletin, 68*, 306-326.

Slavin, R.E. (1987). A theory of school and classroom organization. *Educational Psychologist, 22*, 89-108.

Slavin, R.E. (1994). Quality, appropriateness, incentive, and time: A model of instructional effectiveness. *International Journal of Educational Research, 21*, 141-157.

United States Department of Education (1986). *What works: Research about teaching and learning* (1st. ed.). Washington, DC: Author.

Walberg, H.J. (1981). A psychological theory of educational productivity. In F.H. Farley & N. Gordon (Eds.), *Psychology and Education* (pp. 81-108). Berkeley, CA: McCutchan.

Walberg, H.J. (1984). Improving the productivity of America's schools. *Educational Leadership, 41*(8), 19-27.

Walberg, H.J. (1986). Synthesis of research on teaching. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 214-229). New York: Macmillan.

Wang, M.C., & Lindvall, C.M. (1984). Individual differences and school learning environments. In E.W. Gordon (Ed.), *Review of Research in Education* (volume 11, pp. 161-225). Washington, DC: American Educational Research Association.

Wang, M.C., & Peverley, S.T. (1987). The role of the learner: An individual difference variable in school learning and functioning. In M.C. Wang, M.C. Reynolds, & H.J. Walberg (Eds.), *Handbook of special education: Research and practice. Volume 1: Learner characteristics and adaptive education* (pp. 59-92). Oxford, England: Pergamon Press.

Wang, M.C., & Walberg, H.J. (1991). Teaching and educational effectiveness: Research synthesis and consensus from the field. In H.C. Waxman & H.J. Walberg (Eds.), *Effective teaching: Current research* (pp. 81-104). Berkeley, CA: McCutchan.

Wang, M.C., Haertel, G.D., Walberg, H.J. (1990). What influences learning? A content analysis of research literature. *Journal of Educational Research, 84*, 30-43.

Wang, M.C., Haertel, G.D., & Walberg, H.J. (1993). Toward a knowledge base for school learning. *Review of Educational Research, 63*, 249-294.

Wang, M.C., Haertel, G.D., & Walberg, H.J. (1994). What helps students learn? *Educational Leadership, 51*, 74-79.

Weinstein, C.E., & Mayer, R.E. (1986). The teaching of learning strategies. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 315-327). New York: Macmillan.

Appendix B.

The Q1 Questionnaire

TEACHING AND LEARNING IN THE OPERATING ROOM

STAFF QUESTIONNAIRE

As part of my Master's Thesis in Medical Education, I will be determining and describing the nature of the teaching and learning process in the Operating Room between anaesthesia faculty and residents. The purpose of this questionnaire is for you to give me your opinions about these processes. Hopefully, recommendations made on the results of this questionnaire will make the teaching and learning processes of Anaesthesia Education in the Operating Room more efficient and beneficial for both the staff and resident anaesthetists.

Please answer all of the questions in the context of teaching and learning in the Operating Room. Please note that all responses will remain confidential. Feel free to reflect upon your responses before completing this questionnaire, but please ensure that your responses are your own opinions and not those of others or those which you feel I wish to receive. Place a checkmark in the margin beside any question(s) you would like to discuss with me. As well, feel free to write comments in the margins or in the spaces provided.

Once you have finished this questionnaire, please return it to me. All questionnaire respondents then will be asked to participate in a follow-up personal interview (about 45 minutes in duration), at which time I will ask you for your detailed opinions or clarifications to particular items from the questionnaire. If you have any questions, please contact me or note the specifics and then bring up your concerns during the personal interview.

Thank you for your assistance in my thesis project. SANDY SHYSH

NAME: _____ DATE: _____

NUMBER OF YEARS TEACHING ANAESTHESIA RESIDENTS:

0 - 5 5 - 10 10 - 15 15-20 >20

Before looking at any of the enclosed question sets, please list below the **three most important factors** which you feel affect the teaching and learning processes in the operating room between an anaesthesia resident and a staff anaesthetist:

1.

2.

3.

QUESTIONS ABOUT THE STUDENT Please circle your response

1aS: Currently, how often do you feel the prior learning (the knowledge, skills, and attitudes already learned) of your resident has impact upon learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

1bS: Optimally, how often do you feel teachers of anaesthesia should consider the prior learning of a resident during learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

2S: Currently, how often do you feel the capability of your resident to learn has impact upon learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

3S: Currently, how often do you feel that the motivation to learn of your resident has impact upon learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

4aS: Currently, how often do you feel that the learning style (the preference of the manner in which to acquire, perceive, and process information in the learning situation) of your resident has impact upon learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

4bS: Optimally, how often do you feel teachers of anaesthesia should consider the learning style of a resident during learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

5S: Please list any factors (characteristics or circumstances) of anaesthesia residents (as a group)
which may inhibit them from being ideal learners in the OR:
(e.g. characteristic - not interested all the time, lack proper learning skills)
(e.g. circumstance - too busy covering APS and Emergency surgeries on the weekend, distracted in the OR)

QUESTIONS ABOUT THE TEACHER

7S: Currently, how often do you feel that your teaching style (the preference of the manners/methods/strategies of teaching) has impact upon learning sessions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

8S: Currently, how often do you feel that the teaching style that you currently use is helpful for your resident to learn in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

9S: Please list the types of teaching manners/methods/strategies you feel are most helpful for your resident to learn in the OR:

10S: Currently, do you feel that the amount of time that you spend with your resident during the day on actual learning sessions in the OR is? (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too little ---------- just right ---------- too much

11S: Currently, how would you rate the quality of your instruction to your resident during OR learning sessions? (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too little ---------- just right ---------- too much

12S: Currently, how often do you feel that you exhibit good qualities as a teacher in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

13S: Please list what you consider to be the essential characteristics for being a good teacher in the OR:

14aS: Please list any factors (characteristics or circumstances) of the teachers of anaesthesia which may inhibit them from being ideal teachers in the OR:
(e.g. characteristic - unpaid for teaching, uninterested, lack proper teaching skills)
(e.g. circumstance - too busy to teach, distracted in the OR)

14bS: Do you receive any remuneration for teaching anaesthesia residents in the OR?

Yes -------- No

QUESTIONS ABOUT THE LEARNING ENCOUNTER

16aS: Currently, in OR learning encounters, what percentage of time do you spend teaching your resident

i) knowledge items? _____% }
ii) skills items? _____% } Total 100%
iii) attitudes? _____% }

16bS: Optimally, in OR learning encounters, what percentage of time should teachers of anaesthesia spend teaching residents

i) knowledge items? _____% }
ii) skills items? _____% } Total 100%
iii) attitudes? _____% }

16cS: How effectively do you feel that knowledge items may be **taught** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

16dS: How effectively do you feel that knowledge items may be **learned** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

16eS: Please list the factors that are preventing the effective teaching and/or learning of knowledge items in the OR:

17aS: How effectively do you feel that skills items may be **taught** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

17bS: How effectively do you feel that skills items may be **learned** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

17cS: Please list the factors that are preventing the effective teaching and/or learning of skill items in the OR:

18cS: How effectively do you feel that attitudes may be **taught** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

18cS: How effectively do you feel that attitudes may be **learned** in the OR setting?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

18dS: Please list the factors that are preventing the effective teaching and/or learning of attitudes in the OR:

19S: **Currently**, how frequent is the method of your instruction in the OR centered around each of the following?

a) Question and answer sessions between you and your resident.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

b) Interactive discussions between you and your resident.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

c) Short didactic lecture given by you to your resident (you tell your resident what they need to know).

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

d) Please specify any other ways that you frequently teach knowledge items:

e) You show your resident how to do a skill step-by-step.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

f) You guide your resident through the steps of doing a skill.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

g) Your resident learns on their own (learning by doing /discovering).

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

h) Please specify any other ways that you frequently teach skill items:

i) You discuss with your resident proper ways of how to behave/interact/handle problems with other health care workers.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

j) You show your resident by modeling proper ways of how to behave/interact/handle problems with other health care workers.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

k) You let your resident behave/interact/handle problems with other health care workers in their own way and let them deal with the results.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

l) Please specify any other ways that you frequently teach attitudes:

20S: **Optimally**, how frequent should the method of instruction by teachers of anaesthesia in the OR be centered around each of the following?

a) Question and answer sessions between the teacher and the resident.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

b) Interactive discussions between the teacher and the resident.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

c) Short didactic lecture given by the teacher to the resident (the teacher tells the resident what they need to know).

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

d) Please specify any other ways that teachers should teach knowledge items:

e) The teacher shows the resident how to do a skill step-by-step.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

f) The teacher guides the resident through the steps of doing a skill.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

g) The resident learns on their own (learning by doing / discovering).

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

h) Please specify any other ways that teachers should teach skill items:

i) The teacher discusses with the resident proper ways of how to behave/interact/handle problems with other health care workers.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

j) The teacher shows the resident by modeling proper ways of how to behave/interact/handle problems with other health care workers.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

k) The teacher lets the resident behave/interact/handle problems with other health care workers in their own way and lets them deal with the results.

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

21S) Please specify any other ways that teachers should teach attitudes:

22aS: Currently, how often do you ask questions to your resident in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

22bS: Optimally, how often should teachers ask questions to the resident in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

22cS: Currently, how often does your resident ask you questions in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

22dS: Optimally, how often should residents ask questions to the teacher in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

22eS: Currently, who asks the majority of questions in the OR? Please fill in the approximate %.

You _____% ---------- Resident _____%

22fS: Optimally, who should ask the majority of questions in the OR?

Teacher _____% --------- Resident _____%

22gS: Currently, who leads the majority of discussions in the OR?

You _____% ---------- Resident _____%

22hS: Optimally, who should lead the majority of discussions in the OR?

Teacher _____% --------- Resident _____%

22iS: Please list the factors that prevent the ideal questioning / discussion processes in the OR:

23aS: How advantageous do you feel it is for the resident to have one-on-one learning encounters with teachers in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23bS: Currently, how often do you ask your resident what his/her needs or wants are regarding the next day's learning encounter in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23cS: Currently, how often does your resident tell you what his/her needs or wants are regarding the next day's learning encounter in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23dS: Currently, how often do you tailor the learning encounter in the OR for the specific needs or wants of the individual resident?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23eS: How often do you feel you could tailor the learning encounter in the OR for the specific needs or wants of the individual resident?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23fS: Optimally, how often should the teacher tailor each resident's daily OR learning experience to their individual needs or wants?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

23gS: Please list the factors that prevent you from tailoring each resident's daily OR learning experience to their individual needs or wants:

24S: Currently, how often do you try to get your resident to work through problems so they may solve them for themselves?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

25S: Optimally, how often should teachers try to do this?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

26aS: Currently, on average, do you have expectations of your resident that are: (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too low------a bit low------just right------a bit high------too high

26bS: Optimally, what expectations should teachers have for the resident? (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too low------a bit low------just right------a bit high------too high

27aS: Currently, how often do you give your resident a homework assignment?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

27bS: Optimally, how often should teachers do this?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

28aS: Currently, how often do you decide on what the learning encounter will be on a particular day in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

28bS: Optimally, how often should the teacher decide this?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

28cS: Currently, how often does your resident decide on what the learning encounter will be on a particular day in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

28dS: Optimally, how often should they?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

28eS: Please explain how the knowledge topic or skill activity of the day's learning encounter should optimally be decided?
(e.g. improvised?, pre-arranged?, curriculum-based?)

29aS: Currently, when is the knowledge topic or skill activity decided for the next day's learning encounter in the OR?

NIGHT BEFORE ----- MORNING OF ----- OTHER (Please specify)

29bS: Optimally, when should the knowledge topic or skill activity be decided for the next day's learning encounter in the OR?

NIGHT BEFORE ----- MORNING OF ----- OTHER (Please specify)

29cS: Please explain the factors that prevent the ideal way of determining the topic for the next day's learning encounter in the OR:

30aS: Currently, how often is the knowledge topic or skill activity for the day's learning encounter in the OR related to the cases being done?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

30bS: Optimally, how often should they be related?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

30cS: Please list the factors that interfere with the ideal situation:

31aS: Currently, how often does your resident complete a skills practice outside the OR before attempting the skill in a real-life situation in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

31bS: Optimally, how often should they?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

31cS: Please list the factors that interfere with the ideal situation:

32aS: Currently, do you discuss learning issues / items with your resident in the OR which are: (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too simple ---------- just right ---------- too complex

32bS: Currently, do you feel the length of your discussions with your resident in the OR are: (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
too simple ---------- just right ---------- too complex

33aS: Currently, how often do you prepare a lesson plan for the next day's learning encounter in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

33bS: Optimally, how often should the teacher prepare?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

33cS: Please list the factors that interfere with the ideal situation:

34aS: Currently, at the end of a day, how often do you review with your resident the major points of the day's learning encounter?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

34bS: Optimally, how often should the teacher do so?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

34cS: Currently, how often do you provide your resident with daily feedback on their day's performance?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

34dS: Optimally, how often should the teacher do so?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

34eS: Please list the factors that interfere with the ideal situation:

Please read the following model of teaching and learning:

Phase	Role of the Teacher	Role of the Learner
Phase 1. Modeling	a) Model real-life activity that the learner wants to perform satisfactorily. b) Model states aloud the essence of the activity c) He or she can include tricks of the trade.	d) Observe performance of total activity, not merely the individual steps e) Develop a mental model of what the real thing looks like.
Phase 2. Approximating	f) Providing coaching to the learner. g) Provide support when needed.	h) Approximate doing the real thing and articulate its essence. i) Reflect on the teacher's performance. j) Use self-monitoring and self-correction.
Phase 3. Fading	k) Decrease coaching. l) Decrease providing support.	m) Continue to approximate the real thing. n) Operate in increasingly complex, risky, or ill-defined situations. o) Work individually or in groups.
Phase 4. Self-directed Learning	p) Provide assistance only when requested	q) Practice doing the real thing alone. r) Do so within specified limits acceptable to profession and society.
Phase 5. Generalizing	s) Discuss the generalizability of what has been learned.	t) Discuss the generalizability of what has been learned.

35aS: How often does this model describe the current teaching and learning processes of residents in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

35bS: How often should this model be the way the ideal teaching and learning processes of residents occurs in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

36aS: Please list those statements that do not describe the current teaching and learning processes of residents in the OR (What don't we do?):

36bS: Of those statements which do not describe the current teaching and learning processes of residents in the OR, please list those statements that describe processes which teachers should be doing (Of what we don't do, what should we be doing?):

36cS: Why do you feel we are not doing those processes which you feel we should be doing (what factors are interfering, please list)?

Please read the following definitions and stages of learning:

Stage	Type	Definition / Description
Stage 1	Novice:	One who has no experience of the situations in which they are expected to perform. Acquires new skills through instruction. Learns objective facts and acquires rules for determining actions based upon these facts. Learns situationally-independent (context-free) rules.
Stage 2	Advanced Beginner:	One who can demonstrate marginally acceptable performance. One who has coped with enough real situations to note the recurring meaningful components of the situation.
Stage 3	Competent:	One who has experienced a number of context-free and situationally-dependent cases in real-world circumstances. One who can develop a hierarchical procedure of decision-making by selecting from alternate plans, choosing the most important from a group, and then acting based on the overall goal.
Stage 4	Proficient:	One who has the intuitive ability to perceive situations as a whole, rather than the component parts. Monitors the situation constantly and modifies plans based on prior knowledge of experiences encountered from the past. Thus, can anticipate outcome.
Stage 5	Expert:	One who knows what to do based on mature and practiced understanding. One who has enough experience in a variety of situations and no longer relies on analytic principle to connect their understanding of the situation to an appropriate action.

36dS: How often does this model describe the stages through which the anaesthesia resident goes during residency training in the operating room?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

36eS: For the PGY-1 resident (intern) in the operating room, what should they be learning, what should we be teaching them, and how should it be done?

36fS: For the PGY-2 resident in the operating room, what should they be learning, what should we be teaching them, and how should it be done?

36gS: For the PGY-4 resident in the operating room, what should they be learning, what should we be teaching them, and how should it be done?

36hS: For the PGY-5 resident in the operating room, what should they be learning, what should we be teaching them, and how should it be done?

QUESTIONS ABOUT THE LEARNING ENVIRONMENT

37aS: Currently, how advantageous is it for the anaesthesia resident to learn how to give anaesthetics in the actual operating room environment? (Circle only one number please)

0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10
Not ---------- Very

37bS: Please list the advantageous factors of learning in the actual operating room environment which make it of benefit for the resident to learn how to give anaesthetics:

37cS: Currently, how often do you feel the operating room environment in some way interferes with the learning encounter between you and your resident?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

37dS: Please list the factors of the operating room environment that you find interfere with the learning encounter between you and your resident:

38S: Currently, how often do you find it difficult to carry out a learning encounter in the OR because of limitations due to:

a) noise in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

b) necessity for being quiet for the surgical team?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

c) inadequate space in the OR / equipment in the way?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

d) time requirements for monitoring / attending to your patient / giving an anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

e) other, please list:

39S: Currently, how often do you find it difficult to tell what your resident is thinking or feeling because their face is covered by a facemask?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

40aS: Currently, how often do you stand face-to-face with your resident during learning encounters in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

40bS: Optimally, how often should the teacher stand face-to-face with the resident during learning encounters in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

41aS: When do you feel is the proper time to teach a knowledge item during the day in the OR? Please list:

41bS: When do you feel is the proper time to teach a skills item during the day in the OR? Please list:

41cS: Are there any factors preventing teachers from teaching during these times? Please list:

42aS: Currently, how often do you try to teach your resident something during the maintenance part of the anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

42bS: Optimally, how often should teachers try to teach residents something during the maintenance part of the anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

42cS: Please list the factors that interfere with the ideal situation:

43aS: Currently, how often do you try to teach your resident something during the induction or emergence part of the anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

43bS: Optimally, how often should teachers try to teach residents something during the induction or emergence part of the anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

43cS: Currently, how often do you feel your resident is not listening well enough to what you are saying during a busy moment during an anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

43dS: Currently, how often do you feel your resident is frustrated by being taught during a busy moment during an anaesthetic?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

43eS: Please list the factors that interfere with the ideal situation:

44aS: Currently, how often do you try to teach your resident something between cases?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

44bS: Optimally, how often should teachers try to teach between cases?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

44cS: Currently, how often do you try to teach your resident something at the beginning or end of the day?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

44dS: Optimally, how often should teachers try to teach at the beginning or the end of the day?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

44eS: What is your opinion about teaching between cases or at the beginning or end of the day and/or what factors may interfere with the ideal situation? Please List:

45aS: Currently, during an average day in the OR, what percentage of the time over the whole day are you present with your PGY-*x* resident in the OR theatre?

PGY-1____% PGY-2____% PGY-3____% PGY-4____% PGY-5____%

45bS: Optimally, what percentage of time should the teacher be present with a PGY-*x* resident in the OR theatre?

PGY-1____% PGY-2____% PGY-3____% PGY-4____% PGY-5____%

46aS: Currently, during an average day in the OR, of the time that you are present with your PGY-*x* resident in the OR theatre, what percentage of time do you spend with your PGY-*x* resident on teaching and learning?

PGY-1____% PGY-2____% PGY-3____% PGY-4____% PGY-5____%

46bS: Optimally, what percentage of time should the teacher spend with the PGY-*x* resident on teaching in the OR theatre?

PGY-1____% PGY-2____% PGY-3____% PGY-4____% PGY-5____%

47aS: Currently, during an average day in the OR, how long do you spend with your PGY-*x* resident on teaching and learning in the OR theatre?

PGY-1___h___min PGY-2___h___min PGY-3___h___min

PGY-4___h___min PGY-5___h___min

47bS: Optimally, how long should the teacher spend per day with the PGY-*x* resident on teaching and learning in the OR theatre?

PGY-1___h___min PGY-2___h___min PGY-3___h___min

PGY-4___h___min PGY-5___h___min

48S: Please list the factors that interfere with the ideal situation:

49aS: Currently, how often do you create an atmosphere where your resident feels it is acceptable to say "I don't know"?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

49bS: Currently, how often do you create a climate of learning which is conducive / comfortable for learning?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

49cS: Please list the factors which interfere with the ideal situation:

QUESTIONS ABOUT THE ENVIRONMENT OF THE PROGRAM

50aS: Please list the benefits to having a resident with you in the OR:

50bS: Please list the drawbacks to having a resident with you in the OR:

51aS: Currently, on average, how frequently are you paired with a particular resident?

1 day/month 1 day/week every 2 days/1 week every 2 days/2 weeks

daily for 1 week daily for 2 weeks other (please specify)

51bS: Optimally, on average, how frequently do you feel a particular teacher should be paired with a particular resident?

1 day/month 1 day/week every 2 days/1 week every 2 days/2 weeks

daily for 1 week daily for 2 weeks other (please specify)

51cS: Currently, how frequently are the residents assigned to a particular operating room (e.g. the ortho room, ENT)?

1 day/month 1 day/week every 2 days/1 week every 2 days/2 weeks

daily for 1 week daily for 2 weeks other (please specify)

51dS: Optimally, how frequently do you feel they should be assigned to a particular operating room?

1 day/month 1 day/week every 2 days/1 week every 2 days/2 weeks

daily for 1 week daily for 2 weeks other (please specify)

52S: Please list the factors that interfere with the ideal situation:

53S: Currently, how frequently are the residents assigned to particular cases which are

a) too hard for them to handle on their own:

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

b) hard enough to challenge them:

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

c) easy to handle on their own:

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

d) too simplistic; no challenge:

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

54S: Optimally, how should the residents be assigned to cases in terms of complexity? Please explain: (e.g. easy ones first, difficult ones later)

55aS: Currently, how often do your residents do cases completely on their own?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

55bS: Currently, how often do you feel it frustrate or worries your residents doing cases completely on their own?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

55cS: Currently, how often are you frustrated or worried about your residents doing cases completely on their own?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

55dS: Optimally, how often / what type of cases should the residents do completely on their own? Please explain:

56S: Please list the factors that interfere with the ideal situation:

57aS: Currently, what is the duration of subspecialty rotations in the OR? (e.g. neuro-anaesthesia)

Weekly ----- 2 weeks ----- 1 month ----- 2 months ----- other (please specify)

57bS: Optimally, what should be the duration of such subspecialty rotations in the OR?

Weekly ----- 2 weeks ----- 1 month ----- 2 months ----- other (please specify)

58aS: Currently, how reasonable are the Royal College guidelines regarding the type and duration of mandatory OR rotations?

NOT AT ALL ------ A BIT ------ FAIRLY ------- VERY

58bS: Currently, how reasonable are the Royal College guidelines regarding the type and duration of elective OR rotations?

NOT AT ALL ------ A BIT ------ FAIRLY ------- VERY

58cS: Optimally, how would you change the Royal College guidelines regarding the type and duration of OR rotations? Please explain:

59S: Please list the factors that interfere with the ideal situation:

60aS: Currently, how well do you like the PGY3 year to be exclusively internal medicine?

NOT AT ALL ------ A BIT ------- A LOT ------- VERY

60bS: Currently, how often do you feel it is / would be difficult returning to the OR to give anaesthetics after a year outside of the program doing internal medicine?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

60cS: Optimally, how would you incorporate the year of internal medicine into the anaesthesia residency program? Please explain:

60dS: Please list the factors that interfere with the ideal situation:

61aS: Currently, how often do you feel that the service requirements of the resident interfere with their opportunities for learning in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

61bS: Currently, which service factors interfere with the resident in their opportunities for learning in the OR? Please list:

61cS: Optimally, how would you resolve this issue? (can it be resolved?) Please explain:

61dS: Please list the factors that interfere with the ideal situation:

62aS: Currently, how often is your resident too tired to learn effectively in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

62bS: Currently, how often do situations in your residents' home life affect their ability to learn effectively in the OR?

NEVER --- SOMETIMES --- USUALLY --- ALWAYS

62cS: Please list the factors that interfere with the ideal situation:

63S: Now that you have completed this questionnaire, please list below the **three most important factors** which you feel affect the teaching and learning processes in the operating room between an anaesthesia resident and a staff anaesthetist:

1.

2.

3.

64S: Please feel free to add any comment about your opinions regarding the teaching and learning processes of anaesthesia teachers and residents in the operating room:

65S: Please list those questions which you feel we should review together:

THANK YOU for your considerable time completing this questionnaire!

Appendix C.

The Q2 Questionnaire

CONSENT FORM

Research Project: The Nature of Anaesthesia Education in the Operating Room
Investigator: Dr. Sandy Shysh, The University of Calgary Department of Anaesthesia

This consent form, one copy of which you may keep, is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

Purpose of the research: As part of my Master's Thesis in Medical Education, I will be determining and describing the nature of the teaching and learning process in the Operating Room between anaesthesia faculty and residents. The purpose of this questionnaire is for you to give me your opinions about these processes. I wish to determine the attitudes and beliefs of faculty and resident anaesthetists in our programme so that any interventions suggested by this research may be done with adequate input of both parties involved. Hopefully, recommendations made on the results of this questionnaire will make the teaching and learning processes of Anaesthesia Education in the Operating Room more efficient and beneficial for both faculty and resident anaesthetists. The spirit of this study will be one of collaboration in order to improve the teaching and learning experiences in our programme. Your feedback and constructive criticism of our programme will be promoted in order to identify areas that need improvement.

Recruitment: All faculty and resident anaesthetists associated with The University of Calgary Anaesthesia Residency Programme will be asked to confidentially respond to this questionnaire which will be distributed at departmental rounds or via the departmental mailboxes. I will remind all department members on two subsequent occasions (at two and three months after the initial distribution) during departmental rounds that I request their completion and return of my study questionnaire. Non-responders will not be approached on an individual basis to participate in this study. Participation in this study will be on a purely voluntary basis.

Participation: Time requirements to complete this questionnaire will vary from individual to individual, but it is hoped that only 2-3 hours of your time will be needed. As many questions as possible have been structured to permit you to just circle the appropriate answer. However, space is available to permit you to explain your opinions in your own words. Due to the length of this questionnaire, it is expected that you may not return the completed questionnaire for one to two months.

Follow-up: All responders may be requested to meet with the investigator in a follow-up interview. If so, your personal one-on-one interview will not be of a duration longer than 45 minutes. The purpose of this follow-up interview is to allow you, the

responder, and/or the investigator to clarify any outstanding questions [redacted]
questionnaire. Similarly, any responder may also request a follow-up
investigator to likewise clarify his or her responses. The probability
participate in a follow-up interview will depend on the clarity of yo[redacted]
general responses obtained from the sample.

Responding to Questionnaire Items: Please answer all of th[redacted]
context of teaching and learning in the Operating Room. Feel free to[redacted]
responses before completing this questionnaire, but please ensure that
your own opinions and not those of others or those that you feel I wish
checkmark in the margin beside any question(s) you would like to di[redacted]
well, feel free to write comments in the margins or in the spaces provi[redacted]
identify yourself by name, although this would be helpful. Simila[redacted]
complete any question(s) that you feel uncomfortable in answering
finished this questionnaire, please return it to me with one signed and
consent form.

Confidentiality: All responses will be kept confidential. The
will be kept off-site at the investigator's residence in a locked filin[redacted]
questionnaires will be burned at the conclusion of the study. Respons[redacted]
on a confidential computer database that will be password pro[redacted]
investigator will have access to the questionnaire responses and these [redacted]
be used for the purposes of this research study noted above. Respons[redacted]
by sub-groups only (e.g., by faculty or resident sub-groups), not on an [redacted]

Your decision to complete and return this questionnaire will b[redacted]
indication of your consent to participate in the study and to be appr[redacted]
follow-up interview. Your signature on this form indicates that you [redacted]
your satisfaction the information regarding your participation in the r[redacted]
agree to participate as a subject. In no way does this waive your lega[redacted]
the investigators, sponsors, or involved institutions from their lega[redacted]
responsibilities. You are free to withdraw from the study at any tim[redacted]
participation should be as informed as your initial consent, so you sho[redacted]
for clarification or new information throughout your participation. I[redacted]
questions concerning matters related to this research, please contact [redacted]
phone at his office or home.

If you have any questions concerning your rights as a possibl[redacted]
research, please contact the Office of Medical Bioethics, Faculty
University of Calgary at 220-7990. Please keep a copy of this con[redacted]
records and future reference.

Date	Name (please print)	Signature

Please list any questions, comments, or concerns that you may h[redacted]
consent form:

TEACHING AND LEARNING IN THE OPERATING ROOM

STAFF QUESTIONNAIRE

Please answer all of the questions in the context of teaching and learning in the Operating Room. Feel free to reflect upon your responses before completing this questionnaire, but please ensure that your responses are your own opinions and not those of others or those which you feel I wish to receive. Place a checkmark in the margin beside any question(s) you would like to discuss with me. As well, feel free to write comments in the margins or in the spaces provided.

Please circle only **one** response. Once you have finished this questionnaire, please return it to me through inter-hospital mail. Please note that all responses will remain confidential.

Thank you for your assistance in my thesis project. SANDY SHYSH

NAME: _____ DATE: _____

NUMBER OF YEARS TEACHING ANAESTHESIA RESIDENTS: _____ years

Before looking at any of the enclosed question sets, please list below the **three most important factors** which you feel affect the teaching and learning processes in the operating room between an anaesthesia resident and a staff anaesthetist:

1.

2.

3.

FACTORS AFFECTING LEARNING OUTCOMES:

4. In terms of its impact on teaching and learning in the operating room, how important is:

a) the resident's ability / capability to learn?

Unimportant Of little importance Moderately important Important Very important Don't Know

b) the resident's development / prior learning?

Unimportant Of little importance Moderately important Important Very important Don't Know

c) the resident's motivation to learn?

Unimportant Of little importance Moderately important Important Very important Don't Know

d) the amount of instruction provided?

Unimportant Of little importance Moderately important Important Very important Don't Know

e) the quality of instruction provided?

Unimportant Of little importance Moderately important Important Very important Don't Know

f) the operating room "classroom" learning environment?

Unimportant Of little importance Moderately important Important Very important Don't Know

g) the pressures of the service requirements of the resident's job?

Unimportant Of little importance Moderately important Important Very important Don't Know

h) the pressures of the resident's home life?

Unimportant Of little importance Moderately important Important Very important Don't Know

5. In terms of its impact on teaching and learning in the operating room, how important is it that:

a) residents are a highly diversified group of individuals with widely differing preferences, needs, backgrounds, and skills?

Unimportant Of little importance Moderately important Important Very important Don't Know

b) learning by experience is a major resource in learning situations for residents?

Unimportant Of little importance Moderately important Important Very important Don't Know

c) the self-concept of the resident moves from dependency to independency as they grow in responsibility, experience, and confidence?

Unimportant Of little importance Moderately important Important Very important Don't Know

d) residents tend to be life-centered in their orientation to learning (they tend to want to learn things that will be practical for them later in practice)?

Unimportant Of little importance Moderately important Important Very important Don't Know

e) residents are motivated to learn by a variety of factors?

Unimportant Of little importance Moderately important Important Very important Don't Know

f) active resident participation in the learning process contributes to learning?

Unimportant Of little importance Moderately important Important Very important Don't Know

g) a comfortable supportive environment is a key to successful learning for the resident?

Unimportant Of little importance Moderately important Important Very important Don't Know

MECHANISMS OF OPERATING ROOM TEACHING

6a. Currently, who decides on what the learning encounter will be on a particular day in the OR?

Teacher _____% ---------- Resident _____%

6b. Optimally, who **should** decide on what the learning encounter will be on a particular day in the OR?

Teacher _____% ---------- Resident _____%

7. In terms of its impact on teaching and learning in the operating room, how important is it that:

a) **teachers** should decide on what the learning encounter will be on a particular day in the OR?

Unimportant Of little importance Moderately important Important Very important Don't Know

b) **residents** should decide on what the learning encounter will be on a particular day in the OR?

Unimportant Of little importance Moderately important Important Very important Don't Know

8a. Currently, when is the knowledge topic or skill activity decided for the next day's learning encounter in the OR?

Night before the OR Morning of the OR Other (Please specify)

8b. Optimally, when **should** the knowledge topic or skill activity be decided for the next day's learning encounter in the OR?

Night before the OR Morning of the OR Other (Please specify)

9. In terms of its impact on teaching and learning in the operating room, how important is it that the decision of the knowledge topic or skill activity be made as in question 8b?

Unimportant Of little importance Moderately important Important Very important Don't Know

10a. Currently, how often do you ask your resident what his/her needs or wants are regarding the next day's learning encounter in the OR?

Almost never Infrequently Occasionally Frequently Almost always Don't know

10b. In terms of its impact on teaching and learning in the operating room, how important is it that the teacher consider the needs or wants of the resident?

Unimportant Of little importance Moderately important Important Very important Don't Know

11a. Currently, how often does your resident tell you what his/her needs or wants are regarding the next day's learning encounter in the OR?

Almost never Infrequently Occasionally Frequently Almost always Don't know

11b. In terms of its impact on teaching and learning in the operating room, how important is it that the resident tell the teacher what his/her the needs or wants are?

Unimportant Of little importance Moderately important Important Very important Don't Know

12a. Currently, how often do you prepare a lesson plan for the next day's learning encounter in the OR?

Almost never Infrequently Occasionally Frequently Almost always Don't know

12b. In terms of its impact on teaching and learning in the operating room, how important is it that the teacher prepare a lesson plan?

Unimportant Of little importance Moderately important Important Very important Don't Know

13a. Currently, in OR learning encounters, what percentage of time do you spend teaching your resident

i) knowledge items? _____% }
ii) skills items? _____% } Total 100%
iii) attitudes? _____% }

13b. Optimally, in OR learning encounters, what percentage of time should teachers of anaesthesia spend teaching residents

i) knowledge items? _____% }
ii) skills items? _____% } Total 100%
iii) attitudes? _____% }

14a. In terms of its impact on teaching and learning in the operating room, how important is it that **knowledge** items be taught in the OR setting?

Unimportant Of little importance Moderately important Important Very important Don't Know

14b. In terms of its impact on teaching and learning in the operating room, how important is it that **skills** items be taught in the OR setting?

Unimportant Of little importance Moderately important Important Very important Don't Know

14c. In terms of its impact on teaching and learning in the operating room, how important is it that **attitudinal** items be taught in the OR setting?

Unimportant Of little importance Moderately important Important Very important Don't Know

15a. Currently, how often is the knowledge topic or skill activity for the day's learning encounter in the OR related to the cases being done?

Almost never Infrequently Occasionally Frequently Almost always Don't know

15b. In terms of its impact on teaching and learning in the operating room, how important is it that the knowledge topic or skill activity for the day's learning encounter in the OR be related to the cases being done?

Unimportant Of little importance Moderately important Important Very important Don't Know

16a. Currently, how advantageous is it for the anaesthesia resident to learn how to give anaesthetics in the actual operating room environment?

Almost never Infrequently Occasionally Frequently Almost always Don't know

16b. In terms of its impact on teaching and learning in the operating room, how important is it for the anaesthesia resident to learn how to give anaesthetics in the operating room?

Unimportant Of little importance Moderately important Important Very important Don't Know

17a. Currently, how often does the operating room environment (noise, distractions, workload) in some way interfere with the learning encounter between you and your resident?

Almost never Infrequently Occasionally Frequently Almost always Don't know

17b. In terms of its impact on teaching and learning in the operating room, how important is the operating room environment?

Unimportant Of little importance Moderately important Important Very important Don't Know

18a. Currently, who asks the majority of questions in the OR?
Please fill in the approximate %

You _____% ---------- Resident _____%

18b. Optimally, who **should** ask the majority of questions in the OR?

Teacher _____% ---------- Resident _____%

18c. In terms of its impact on teaching and learning in the operating room, how important is it that **teachers** pose questions to residents?

Unimportant Of little importance Moderately important Important Very important Don't Know

18d. In terms of its impact on teaching and learning in the operating room, how important is it that **residents** pose questions to teachers?

Unimportant Of little importance Moderately important Important Very important Don't Know

20a. Currently, how often do you try to teach your resident something during the maintenance part of the anaesthetic?

Almost never Infrequently Occasionally Frequently Almost always Don't know

20b. In terms of its impact on teaching and learning in the operating room, how important is it that teaching be done during the maintenance part of the anaesthetic?

Unimportant Of little importance Moderately important Important Very important Don't Know

21a. Currently, how often do you try to teach your resident something during the induction or emergence part of the anaesthetic?

Almost never Infrequently Occasionally Frequently Almost always Don't know

21b. In terms of its impact on teaching and learning in the operating room, how important is it that teaching be done during the induction or emergence part of the anaesthetic?

Unimportant Of little importance Moderately important Important Very important Don't Know

22a. Currently, how often do you try to teach your resident something between cases?

Almost never Infrequently Occasionally Frequently Almost always Don't know

22b. In terms of its impact on teaching and learning in the operating room, how important is it that teaching be done between cases?

Unimportant Of little importance Moderately important Important Very important Don't Know

23a. Currently, how often do you try to teach your resident something at the beginning or end of the day?

Almost never Infrequently Occasionally Frequently Almost always Don't know

23b. In terms of its impact on teaching and learning in the operating room, how important is it that teaching be done at the beginning or the end of the day?

Unimportant Of little importance Moderately important Important Very important Don't Know

24. Currently, how often do you feel that your resident finds it difficult to carry out a learning encounter in the OR while he / she gives an anaesthetic / monitors the patient?

Almost never Infrequently Occasionally Frequently Almost always Don't know

25a. Currently, how would you rate the amount of time that you spend with your resident during the day on actual learning sessions in the OR is? (Circle only one number please)

Extremely inadequate Below average Average Above average Excellent

25b. In terms of its impact on teaching and learning in the operating room, how important is the amount of time that the teacher spends with the resident during the day on actual learning sessions?

Unimportant Of little importance Moderately important Important Very important Don't Know

26a. Currently, how would you rate the quality of your instruction to your resident during OR learning sessions? (Circle only one number please)

Extremely inadequate Below average Average Above average Excellent

26b. In terms of its impact on teaching and learning in the operating room, how important is the quality of instruction to the resident during OR learning sessions?

Unimportant Of little importance Moderately important Important Very important Don't Know

27a. Currently, during an average day in the OR, what percentage of the time over the whole day are you present with your PGY-*x* resident in the OR theatre?

PGY-1___% PGY-2___% PGY-3___% PGY-4___% PGY-5___%

27b. Optimally, what percentage of time over the whole day **should** the teacher be present with a PGY-*x* resident in the OR theatre?

PGY-1___% PGY-2___% PGY-3___% PGY-4___% PGY-5___%

27c. In terms of its impact on teaching and learning in the operating room, how important is the overall length of time that the teacher spends in the room with the resident?

PGY-1 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-2 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-3 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-4 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-5 Unimportant Of little importance Moderately important Important Very important Don't Know

28a. Currently, during an average day in the OR, of the time that you are present with your PGY-*x* resident in the OR theatre, what percentage of time do you spend with your PGY-*x* resident on teaching and learning?

PGY-1___% PGY-2___% PGY-3___% PGY-4___% PGY-5___%

28b. Optimally, what percentage of time **should** the teacher spend with the PGY-*x* resident on teaching in the OR theatre?

PGY-1___% PGY-2___% PGY-3___% PGY-4___% PGY-5___%

28c. In terms of its impact on teaching and learning in the operating room, how important is the length of time the teacher spends with the resident on teaching and learning?

PGY-1 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-2 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-3 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-4 Unimportant Of little importance Moderately important Important Very important Don't Know

PGY-5 Unimportant Of little importance Moderately important Important Very important Don't Know

29a. Currently, during an average day in the OR (say 8 hours), how long do you spend with your PGY-*x* resident on teaching and learning in the OR theatre?

PGY-1___h___min PGY-2___h___min PGY-3___h___min
PGY-4___h___min PGY-5___h___min

29b. Optimally, how long **should** the teacher spend per day with the PGY-*x* resident on teaching and learning in the OR theatre?

PGY-1___h___min PGY-2___h___min PGY-3___h___min
PGY-4___h___min PGY-5___h___min

30a. Please list the benefits to having a resident with you in the OR:

30b. Please list the drawbacks to having a resident with you in the OR:

31a. Currently, how often do your residents do cases completely on their own?

Almost never Infrequently Occasionally Frequently Almost always Don't know

31b. In terms of its impact on teaching and learning in the operating room, how important is that residents do cases completely on their own?

Unimportant Of little importance Moderately important Important Very important Don't Know

32a. Currently, how often do you feel it frustrate or worries your **residents** doing cases completely on their own?

Almost never Infrequently Occasionally Frequently Almost always Don't know

32b. Currently, how often are **you** frustrated or worried about your residents doing cases completely on their own?

Almost never Infrequently Occasionally Frequently Almost always Don't know

Please read the following model of teaching and learning:

Phase	Role of the Teacher	Role of the Learner
Phase 1. Modeling	a) Model real-life activity that the learner wants to perform satisfactorily. b) Model states aloud the essence of the activity c) He or she can include tricks of the trade.	d) Observe performance of total activity, not merely the individual steps e) Develop a mental model of what the real thing looks like.
Phase 2. Approximating	f) Providing coaching to the learner. g) Provide support when needed.	h) Approximate doing the real thing and articulate its essence. i) Reflect on the teacher's performance. j) Use self-monitoring and self-correction.
Phase 3. Fading	k) Decrease coaching. l) Decrease providing support.	m) Continue to approximate the real thing. n) Operate in increasingly complex, risky, or ill-defined situations. o) Work individually or in groups.
Phase 4. Self-directed Learning	p) Provide assistance only when requested	q) Practice doing the real thing alone. r) Do so within specified limits acceptable to profession and society.
Phase 5. Generalizing	s) Discuss the generalizability of what has been learned.	t) Discuss the generalizability of what has been learned.

33a. Currently, how often does this model describe the current teaching and learning processes of residents in the OR?

Almost never Infrequently Occasionally Frequently Almost always Don't know

33b. In terms of its impact on teaching and learning in the operating room, how important is it that this model of teaching and learning be used for teaching anaesthesia residents?

Unimportant Of little importance Moderately important Important Very important Don't Know

34. In order to learn how to teach,

a) have you ever audited, or taken for credit, a course on how to teach? NO YES
b) have you ever participated in a workshop on how to teach? NO YES
c) do you teach the way in which you were taught? NO YES
d) do you teach by just trying different teaching methods on your own? NO YES

34e. In terms of its impact on teaching and learning in the operating room, how important is it that teachers formally learn how to teach properly?

Unimportant Of little importance Moderately important Important Very important Don't Know

35a. Currently, how often do you feel that your teaching style (manners / methods / strategies) has impact upon learning sessions in the OR?

Almost never Infrequently Occasionally Frequently Almost always Don't know

35b. In terms of its impact on teaching and learning in the operating room, how important is the teacher's teaching style?

Unimportant Of little importance Moderately important Important Very important Don't Know

36a. Currently, at the end of a day, how often do you review with your resident the major points of the day's learning encounter?

Almost never Infrequently Occasionally Frequently Almost always Don't know

36b. In terms of its impact on teaching and learning in the operating room, how important is it that teachers review with the resident the major points of the day?

Unimportant Of little importance Moderately important Important Very important Don't Know

37a. Currently, how often do you provide your resident with daily feedback on their day's performance?

Almost never Infrequently Occasionally Frequently Almost always Don't know

37b. In terms of its impact on teaching and learning in the operating room, how important is it that teachers provide the resident with daily feedback?

Unimportant Of little importance Moderately important Important Very important Don't Know

OVERALL IMPORTANT FACTORS

38. From the following list of 28 items, please rank five (from 1 to 5 with 1 being the most important), the five factors that you feel most greatly influence teaching and learning in the operating room for **any** anaesthesia residency programme: (i.e., what five factors are the most important to allow students to learn anaesthesia in the operating room?)

		RANK
Factors of the student:	1. Resident's motivation / enthusiasm	_____1
	2. Resident's tiredness	_____2
	3. Resident's receptiveness to learn	_____3
	4. Resident's learning skills	_____4
	5. Resident's content knowledge	_____5
	6. Resident's preparation to learn	_____6
	7. Other (please specify):	_____7
Factors of the teacher:	8. Faculty's motivation / enthusiasm	_____8
	9. Faculty's tiredness	_____9
	10. Faculty's willingness to teach	_____10
	11. Faculty's teaching skills	_____11
	12. Faculty's content knowledge	_____12
	13. Faculty's preparation to teach	_____13
	14. Other (please specify):	_____14
Factors of the student - teacher interaction:	15. Communication (both ways)	_____15
	16. Relationship, trust	_____16
	17. Flexibility	_____17
	18. Personalities	_____18
	19. Other (please specify):	_____19
Factors of the operating room teaching and learning environment:	20. The case list for the day	_____20
	21. OR environment (busy, noise, workload)	_____21
	22. Other (please specify):	_____22
Factors of the anaesthesia residency programme:	23. Royal College requirements	_____23
	24. PGY-3 year exclusively Internal Medicine	_____24
	25. Other (please specify):	_____25
Other general factors:	26. Health Care restructuring	_____26
	27. Medical students deciding on career pathway so early on in their training	_____27
	28. Other (please specify):	_____28

39. For each of the five factors that you have chosen in question 38, please define the extent to which **our** residency training programme meets the ideal:

a) In terms of the factor that I ranked of 1st importance, our programme is exactly ideal.

Strongly disagree Disagree Neutral Agree Strongly Agree

b) In terms of the factor that I ranked of 2nd importance, our programme is exactly ideal.

Strongly disagree Disagree Neutral Agree Strongly Agree

c) In terms of the factor that I ranked of 3rd importance, our programme is exactly ideal.

Strongly disagree Disagree Neutral Agree Strongly Agree

d) In terms of the factor that I ranked of 4th importance, our programme is exactly ideal.

Strongly disagree Disagree Neutral Agree Strongly Agree

e) In terms of the factor that I ranked of 5th importance, our programme is exactly ideal.

Strongly disagree Disagree Neutral Agree Strongly Agree

40. For each of the five factors that you have chosen in question 38, please explain why our programme may not be ideal (please list the things that may be inhibiting each factor):

a) Things inhibiting Factor 1:

b) Things inhibiting Factor 2:

c) Things inhibiting Factor 3:

d) Things inhibiting Factor 4:

e) Things inhibiting Factor 5:

41. Any other comments about our residency programme?

42. Any other comments about the factors of importance in promoting or providing effective teaching and learning in the operating room for **any** anaesthesia residency programme?

43. Any comments about this questionnaire?

44. Please list any questions that you did not understand or those that you wish to discuss with me:

THANK YOU for your considerable time in completing this questionnaire!

Appendix D.

Linear Transformation of Scales to the 5-point Scale.

(see Allen & Yen, 1979, p. 149)

1. The conversion from a 4-point to a 5-point ordinal scale is $[\ 4/3\ (x\text{-}1)\ ] + 1 = y$, where x = the value on the 4-point scale and y = the value on the 5-point scale. Equivalent ratings:

x	1	2	3	4
y	1	2.33	3.67	5

2. The conversion from a 2-point scale (e.g., Questionnaire 1, question 29) to a 5-point ordinal scale is $[\ 4\ (x\text{-}1)\ ] + 1 = y$, where x = the value on the 2-point scale and y = the value on the 5-point scale. Equivalent ratings:

x	1	1.5	2
y	1	3	5

3. The conversion from an 11-point (0-10) scale (e.g., Questionnaire 1, question 26) to a 5-point ordinal scale is $(4/10\ x) + 1 = y$, where x = the value on the 11-point scale and y = the value on the 5-point scale. Equivalent ratings:

x	0	1	2	3	4	5	6	7	8	9	10
y	1.0	1.4	1.8	2.2	2.6	3.0	3.4	3.8	4.2	4.6	5.0

4. The conversion from a 0-100 linear scale (e.g., Questionnaire 1, question 16) to a 5-point ordinal scale is $(4/100\ x) + 1 = y$, where x = the value on the 0-100 scale and y = the value on the 5-point scale.