Introduction

Certified Registered Nurse Anesthetists (CRNAs) must master a number of complex motor skills and develop efficient and accurate problem-solving skills for an ever-changing environment. CRNAs monitor many modalities, assess changing environments, and must proceed with actions to support the holistic psychological and physiological needs of the client during complex surgical procedures. Yet, how nurse anesthetists gain the competencies needed to practice nurse anesthesia has been unexplored. The purpose of this study was to understand and describe the learning processes of expert CRNAs.

Review of literature

Much has been written concerning instruction and learning. Dewey, who traditionally concerned himself with pedagogical education, wrote extensively about the importance of experience in learning and the lifelong nature of learning. Members of the behaviorist school view learning as a change in behavior. Humanists see learning as a progression toward self-actualization, an improvement in self-awareness and perception. A third group, cognitive theorists, views learning as an internal intellectual process involving insight, information processing (encoding, decoding), memory, and perception. Understanding the essential structure of a discipline must accompany learning so that as parts of a subject are learned they are encoded and related to the other components of the discipline in a meaningful way.

Fourth, social and situated learning theorists highlight the importance of social context to learning. They describe knowledge as a “product of the activity and situations in which [it is] produced,” which is redefined as new situations, environments, and facts are experienced. For situated learning theorists, learning is not an internal, cerebral function within the individual, nor is it a completely external phenomenon.

There are many models to describe the learning process; however, understanding of specific learner populations remains limited. The learning processes of CRNAs who learn and develop clinical practices within a highly technological environment requiring accurate and efficient problem-solving, observational, and motor skills have not been described. Further exploration into the learning processes of CRNAs is needed.

Method

A qualitative case study design was chosen to explore the learning processes of expert nurse anesthetists. Qualitative studies are designed to intensively study an object. Comprehensiveness and in-depth understanding are primary concerns in qualitative research; thus, many variables and contextual contributions are explored. Qualitative studies do not seek to find the one “right” answer. The emphasis on frequency and representativeness give way to in-depth comprehension and fullness of understanding. There is not a single perception; rather reality is multifaceted (Table).

Learning is a contextual, complex, and dynamic process. It is multifaceted, involving internal and external processes. Thus, a qualitative method is appropriate to fully explore learning processes.
Qualitative case studies describe and analyze a particular situation, process, or group, while allowing exploration of numerous variables and the context. Case studies explore how something is done or came about.

The object in a case study is “bounded.” There are certain identifiers that describe what the case is and what the case is not. The case for this study involved expert nurse anesthetists practicing within the team approach to provision of anesthesia at a large metropolitan trauma center. Expert nurse anesthetists were defined as practitioners who: (1) maintained current certification from their national council, (2) updated and upgraded their skills and techniques in response to technological and pharmacological advances within the field, (3) possessed at least 5 years of experience providing anesthesia, and (4) were identified as expert practitioners by their peers and superiors. The appropriateness of these criteria were confirmed by a 3-member panel of anesthesia educators and a pilot study.

Purposeful sampling, in which participants are chosen based on their knowledge and experience of the phenomenon under investigation, was used in this study. One of the 5 participants was unable to complete final interviews due to a medical emergency. A panel of 5 doctorally prepared educators (in the field of adult education) verified informant eligibility and sample size.

Data collection involved interviews, observations, and document review. Initial interviews were open ended and asked the following questions: (1) Would you describe how you go about integrating a new drug product? (2) Would you describe a clinical experience that was particularly problematic for you and how you went about solving the problem? (3) Would you tell me about a learning experience that you felt was most helpful as you learned how to be a nurse anesthetist?, and (4) What learning experience has been the least helpful as you have learned how to practice nurse anesthesia? Questions about problem solving or integrating a new medication into one’s practice were used to identify current learning processes. Looking at what was not helpful to learning was used for comparison and verification of the learning process preferences.

Subsequent phases of the interview process filled in gaps, clarified common phrases, enhanced researcher understanding, compared and contrasted experiences of each CRNA, and documented saturation (when no more new information is being obtained) and participant verification (respondent agrees with the portrayal of his or her experience). Observations of CRNAs in the operating room environment provided an understanding of the social and cultural context (natural setting) within which the participants learned and practiced.

Last, several documents were reviewed to explore possible influences on CRNA learning from the following: (1) formalized educational institutions, (2) published standards of care, and (3) the national nursing anesthesia organization and its accrediting council.

After obtaining human assurance committee approval, informants were given written information about the study, and written consent was obtained. Interviews were audiotaped and transcribed verbatim. Interview transcripts and field and researcher notes were analyzed using the Tesch 8-step model to identify salient categories as they emerged from the data. Data were coded and analyzed using the QSR Nud*ist software program (Qualitative Solutions and Research Pty Ltd, La Trobe University, Victoria, Australia).

Validity was demonstrated through member checks with each CRNA, peer review, and methodological triangulation of the data sources. Reliability was documented by an “audit trail,” conducted by a doctorally prepared and experienced qualitative researcher.
Results
In looking at expert nurse anesthetists, one is able to identify 3 stages in learning: (1) seeking of basic information (“those important basics”), (2) continued practice (“just do it”), and (3) development of confidence, comfort, and finesse (“getting the feel”). Fictitious names have been used to protect the identity of each informant and to allow the reader to compare each informant’s responses throughout the study.

- **Those important basics.** When confronted with a new situation, agent, or technique in their practice, expert nurse anesthetists follow a similar path in their learning (Figure). At first, expert CRNAs find material that provides them with pathophysiological, physiological, or pharmacological knowledge concerning the situation. Judy would “read the inserts and any handouts that we might have gotten.”

The basics provide an organizational framework so that information, formal or experiential, can be labeled and categorized. This promotes retrieval of knowledge in an efficient manner when it is needed for transference of information to other related circumstances. Knowledge of the basics is not simple memorization of “dos” or “do nots.” If it were, clinical actions would be based on an infinite, unmanageable list of rules. Understanding principles provides CRNAs with direction and rationale for the anesthetic plan and technique implemented for a given patient.

The basics are very important to CRNAs as they maintain and demonstrate expertise. The basic principles are not something a CRNA forgets, nor are they always at the forefront of practice. Carole states: “I think they are always in the back of your mind. I don’t think that they are foremost in your mind as you are administering the drug, but I think that they are always there. That is how you initially became familiar with the drug. And, I don’t feel that those things tend to leave you.”

- **Just do it.** Learning for CRNAs involves not only mastery of scientific content but also application of scientific principles into clinical practice, further legitimizing these principles as important structural components to anesthesia practice. Reading or talking with others about a new situation is not enough; the CRNA must experience it first hand. Carole states: “You have to get in there and you have to do all of that, you just can’t stay away from it…. I mean, reading about it kind of sets it off, but until you do it, but until you see it, you really don’t know.”

However, this is not to indicate that reading and exploring didactic content is replaced by experience, or vice versa, but rather the two must go hand in hand. Gayle explains: “It is not all experience. Because certainly in the training you get, you get it academically, you get it in the classroom. But to act on it and put it all together, I think that really comes from experience.”

Hands-on experience enriches the basic information with environmental cues that are gained through tactile, auditory, and visual means. Carole describes the importance of touch during insertion of an epidural catheter: “The books tell you to go for loss of resistance, but you can’t imagine what they’re saying until you have done it. And it is hard to teach [others]. You can help them, you can help walk them through it, but they really have to develop their own feel for it.”

Other environmental cues are not so self-evident. These cues are more intuitive, operating at a subconscious level, and are not so readily amenable to definition and identification. Carole describes her experience with an obstetrical patient: “You can walk into a room sometimes and you can know that there is a problem and know exactly what to do even when others might be just kind of flustered and running around, and you just do it.”

Experience is what promotes a complete, working understanding of the basic principles. The principles are perceived and experienced mentally, visually, through touch, and intuitively. These perceptions become knowledge pieces that are stored and organized within the expert’s practice structures. When integrated, knowledge pieces are organized into packages or practice structures that contain basic physiological or pharmacological principles, salient environ-
mental cues, and important emotional factors. In addition to identification material, practice structures contain lists of possible alternative actions based on past experiences. Practice structures form the basis from which experts choose an anesthetic, assess environmental stimuli, and solve problems. Practice structures define how one goes about “doing things.”

Practice structures are individualized and holistic. Judy describes the uniqueness of practice structures: “As we progress, we just learn our own ways of doing things. And it just works. [Others] can come right behind us and try to do it, and it doesn’t work for them the same way. Let’s say I did this or that for this patient, and I wrote down exactly the amount of drugs I gave and when I gave them and then give [the information] to [another who does] it; it might not be as pretty.”

- Finesse, confidence, comfort. When experts access their practice structures, they are able to review basic principles, clinical interventions, and expected outcomes all at once. This makes experts quick, efficient, and comfortable in most situations. Experts do not worry or fret; they know and already have successfully handled many troublesome situations efficiently and expediently. They know what it is they need to do when caring for their patients. They “have the feel.”

As expert CRNAs experience new situations and learn new information, links are made to existent, complex practice structures. In this manner, new knowledge is integrated into and enhances expert practice structures. Experts use complex practice structures to develop hierarchical taxonomies or priorities of practice. With hierarchical taxonomies, practitioners solve problems based on the likelihood of a solution. For example, when confronted with hypotension, experts rank and review practice structures concerning hypotensive episodes. In the maze of incoming data, experts use practice structures to discard extraneous data and discern the important, but often subtle pieces of important information. This makes experts efficient. Bob describes his assessment activities during a malignant hyperthermic episode: “What was I looking at? I was looking at the elevated heart rate, the elevated blood pressure, the color, the cyanosis starting in. I mean just all of those things. I was looking at the patient.”

Experts are very attuned to important environmental cues, so much so that often they detect changes and implement needed interventions before others who are less experienced detect a downward trend or untoward sign. This ability makes them seem almost clairvoyant in their practice. Carole describes experienced CRNAs who trained her: “It was just amazing to me that they just had this feel for anesthesia. It was almost like their sixth sense…. It was like palpating a pulse or listening to a precordial and then knowing something was going to happen before it even happened.”

Carole describes her own sixth sense after years of experience: “[You may ask me] why did you turn the gas up? I just felt like I needed to turn it up a little bit. [You say] but I didn’t see anything change on the monitor or the vital signs. No, but if I hadn’t turned it up, I probably was going to need to. I think that’s probably the art of it. It’s getting the feel.”

Because of the extensive practice structures, experts are able to confront many situations, assess a wealth of data, and implement interventions expeditiously and efficiently. Expert practice is demonstrated by a relative grace and finesse as an anesthetic is administered. Bob likens expert practice to the creation of a picture: “I think that the art of anesthesia is using the knowledge you have and painting a pretty picture. Making it look good. The patient goes to sleep nice. They’re very, the patient, is very comfortable with you when you put them to sleep….I think that is the art of anesthesia.”

Expert practice is a matter of finesse. Expert practice is when one is comfortable with oneself and the tools used in the trade; it is the smoothness with which an airway is maintained, a spinal needle inserted, a central vein cannulated. It is not something that can be copied or imitated. Bob explains: “I don’t think anesthesia is a recipe…. It’s the timing and how you look with the mask and the bag and the feel.”

Discussion
Scientific (physiological and pharmacological) principles are important in CRNA learning and practice. The principles provide a framework for knowledge retention and retrieval, and they guide practice. The importance that expert CRNAs give to scientific principles may be related to the emphasis that training programs and their accrediting body give this content. Of the 450 required contact hours by the AANA Council on Accreditation, 270 hours (60.0%) are required in the hard sciences (anatomy, physiology, pathophysiology, chemistry, physics, and pharmacology).22 Thus, graduate nursing anesthesia education may enculturate students with the importance of theoretical principles. However, it seems unlikely that expert practitioners would continue to use knowledge structures found unfruitful in clinical practice.

A more likely explanation for the importance of scientific principles to CRNA learning may be found in the nature of CRNA clinical practice. CRNA practice, as well as other areas of advanced practice nurs-
ing, is characterized by a greater degree of independence and responsibility. The serious consequences of anesthesia mishaps and the heightened legal and moral responsibilities found in CRNA practice may be strong motivators for the retention of scientific facts and principles.

In addition, CRNAs practice as members of the perioperative or surgical care team. This team consists of individuals who are highly trained and have been immersed in the scientific method and the value of analytical, rational thinking patterns. During training and in clinical practice, CRNAs explain, justify, and defend their anesthesia interventions during interactions with their peers, other members of the perioperative team, and the patient. In doing so, CRNAs rely heavily on scientific principles and logical reasoning. Thus, the culture of CRNA practice may reinforce the importance of the scientific principles.

Last, nurse anesthetists many times select and administer interventions within a matter of seconds with effects targeted at life-sustaining systems (brain, heart) in their patients. It is not unusual that decisions of this magnitude involve rationalization and justification. Scientific principles, in this context, assist in providing a solid rationalization.

Another concept of interest is the importance of doing in the learning of the expert CRNA. To fully “know” the basic principles, expert CRNAs must practice and perform within a real-world environment. Doing is a part of learning; learning and doing are inseparable. CRNAs must struggle with problems that hold meaning and have significance for them in their world, the operating room. The consequences of their actions are significant, and their decisions must be correct. There exist very few absolutes. Most answers are situational, derived from the context of each individual patient and the surgical procedure. Answers emerge from data gleaned from the situation, guided by abstract scientific principles. Mastery cannot develop without contextualized experience.

Thus, learning for the expert nurse anesthetist involves understanding a wide range of physiological, pathophysiological, and pharmacological principles. These principles are, in turn, expanded and contextualized through clinical practice until comfort and confidence develop. Experts learn by knowing the basics and implementing them in clinical practice. These processes occur simultaneously. As such, training for experts should involve the simultaneous offering of knowing and doing. Instructional strategies designed to meet this goal, such as problem-based learning, computer case studies, anesthesia patient simulation, and anatomic and animal laboratory exercises, may be useful for training experts (and those who desire development of expertise).

Recommendations

This study represents an initial look into the learning processes of CRNAs. Yet many aspects of CRNA learning remain unexplored. For instance, despite the highly analytical methods CRNAs use during anesthesia administration, expert CRNAs demonstrate the use of intuition and pattern recognition skills in their practices. Studying the development and implementation of these skills should provide additional insight into CRNA learning. Also, group processes, social interactions, and culture that influence CRNAs and their learning are, as yet, unexplored.

Summary

Expert CRNAs follow a consistent path in their learning (see Figure). Nurse anesthetists first go to “the basics” where they acquire the pharmacological and physiological principles important to anesthetic conduct. After the basics are acquired, CRNAs “try it out.” As CRNAs try out and experience, enhanced fullness and depth of meaning are integrated into the basic principles, enriching them with important cues and stimuli that are necessary for expert use and implementation of the basic principles. Expansion of the basic principles with clinical experience results in large packages of knowledge or practice structures.

As practice structures accumulate, a sense of “settling” or comfort is developed. Experts call this level of achievement “getting the feel” or the “art of anesthesia.” It is characterized by confidence in one’s abilities, a calmness and sureness in practice, a smoothness or finesse in how one “goes about doing.”

REFERENCES


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