Adult Education Quarterly
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Adult Education Quarterly 1999 49: 133
DOI: 10.1177/074171369904900401

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ADULT EDUCATION QUARTERLY
Volume 49, Number 4, Summer 1999, 133-147

NOVICE TO EXPERT: AN EXPLORATION OF HOW PROFESSIONALS LEARN

BARBARA J. DALEY

ABSTRACT

Although researchers have recently focused on the nature of expertise, the link between learning and the development of expertise remains to be more fully explored. The purpose of this study was to analyze the different learning processes undertaken by novices and experts. Twenty semi-structured interviews were conducted with novice and expert nurses for the purpose of analyzing and comparing how their learning developed in clinical practice. Results indicated that novice learning is contingent on concept formation and assimilation. Novice learning is also framed by the feelings novices experience in the context of practice. Expert learning, on the other hand, was identified as a constructivist process using active concept integration and self-initiated strategies. Additionally, novices and experts identified different organizational factors that facilitated or hindered their learning. Experts were able to articulate systemic issues that affected their learning, whereas novices identified disparate individual issues. Implications for research and practice of continuing professional education are examined.

The connection between learning and the development of practice is an issue at the heart of continuing professional education. Over the course of their careers, professionals change how they think, how they act in practice, and how they interact with clients. Professionals use their experiences as the basis for making these changes and for refining their practice. This study addresses the question of how professionals learn to change their practice. As professionals gain more experience and develop more expertise, how does their learning change? Do professionals learn differently at the beginning of their careers than later on? What implications does understanding professional learning have for the planning and designing of continuous education programs?

In the United States, business and industry, including health care, spend billions of dollars on the training and development of professionals. In fact, "employers spend over $50 billion per year on formal employee training and education. Approximately $180 billion per year is spent on informal, on-the-job training" (Rowden, 1996, p. 3). It is this author's belief that most of this education targets the novice professional and, therefore, teaching techniques are used that foster the learning of novices. Uncovering the differences between how novices and experts learn can help shape professional development programs and enhance the learning outcomes for novices and experts.

The prevailing wisdom in regard to professional development is that novice professionals will develop expertise based on the experiences they encounter in their work setting. Roger's "adoption of innovation model" (1971, 1983) described

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how practice changes are initiated after the learner adopts a new idea and transfers it to the practice setting. Early work in continuing professional education (Houle, 1989; Cervero, 1988) showed that professionals learn in one setting and transfer that information to their work environment. Schön (1987), Eraut (1994), Brookfield (1995), and Cranton (1997) expanded this view in their work on the development of reflective practice in professionals but stopped short of identifying the actual learning processes used in reflective practice. Ferry and Ross-Gordon's study of extension educators explored the links between experience and reflective practice. In their view, "the key to expertise does not seem to reside in merely gaining experience, but in how the individual uses experience as a learning mechanism" (Ferry & Ross-Gordon, 1998, p. 107).

The Study of Professional Expertise and Its Development

Theories of expertise and studies of its development have moved through two generations (Holyoak, 1991). The first generation of studies was short-lived and focused on understanding expertise as serial problem-solving that could be applied across a wide range of knowledge and professional domains (Newell & Simon, 1972). Second generation studies, on the other hand, examined specific professional development patterns in physicists (Chi, Feltovich, & Glaser, 1980), pilots (Dreyfus & Dreyfus, 1980, 1985), nurses (Benner, 1982, 1983, 1984; Benner & Tanner, 1987; Tanner, Padrick, Westfall, & Putzier, 1987), physicians (Groen & Patel, 1988; Patel & Groen, 1991), radiologists (Lesgold, Rubinson, Feltovich, Glaser, Lopfer, & Wang, 1988), trainers (Swanson & Flakman, 1997), teachers (Cleary & Groer, 1994; Kremer-Hayon, 1991), environmental educators (Tudor, 1992), counselors (Etringer, Hillerbrand, & Claiborn, 1995) and judges (Lawrence, 1988). These studies demonstrated that professionals grow in their chosen career as they gain experience within the context of their work setting. Second generation studies demonstrated that professionals move through a developmental continuum in which they progress from novice to expert. For example, studies in physics analyzed the differences between experts and novices in solving physics problems. Findings indicated that "experts initially abstract physics principles to approach and solve a problem representation, whereas novices base their representation and approaches on the problem's literal features" (Chi, Feltovich, & Glaser, 1980, p. 121).

Dreyfus and Dreyfus (1980, 1985) demonstrated that professionals move through five stages of career development which they labeled "novice," "advanced beginner," "competent," "proficient" and "expert." Studies with nurses and pilots showed that novice professionals tend to govern their practice with rule-oriented behavior (Dreyfus & Dreyfus, 1985; Benner, 1982, 1984; Benner & Tanner, 1987). Since novices have little experience with real situations, they must rely on the rules they have learned in their prepatory education to function. As the novice professional moves on to the advanced beginner stage, increasingly acceptable performance is demonstrated. According to Benner (1982, p.403), "This person [advanced beginner] is one who has coped with enough real situations to note the recurrent meaningful situational components." Advanced beginners start to differentiate situations but still have great difficulty distinguishing the important from the unimportant. Competent professionals have usually

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been in practice three to five years. These professionals can organize and plan activities; they are consciously aware of the plan and feel they have an ability to cope with unpredictable situations. The proficient professional, however, begins to have a holistic sense of the work. For example, proficient nurses have an understanding of the client, begin using maxims or short-coded statements to describe client care, and discern aspects of care that stand out as most important.

Finally, the expert professional "has an intuitive grasp of the situation and zeros in on the accurate region of the problem without wasteful consideration of a large range of unfruitful possible problem situations" (Benner, 1982, p. 406). Expert nurses, for instance, have an unusual perceptual ability to recognize patterns in clinical situations (Benner, 1984). This pattern recognition goes beyond the theoretical and applies to the uncertainty of real-life situations. Experts also possess the skill of similarity recognition; that is, the capacity to recognize similarities in client conditions even though the presenting symptoms or situation may be dissimilar. It also involves a common-sense and a profound understanding of the client's experience. This understanding is often based on similarities in language, culture, and experience between the expert and the client. Experts also develop a sense of salience so that all tasks, observations, and interventions are not seen as equally important. Rather, the high-priority specifics for that client are identified and acted upon. Finally, experts develop "deliberative rationality" or a "deep web of perspectives that causes them to view a situation in terms of past situations. Thus, the expert has learned to expect certain events and even selectively to attend to certain aspects of the situation" (Benner & Tanner, 1987, p. 28).

Dreyfus and Dreyfus (as cited in Benner, 1984) stated that the movement from novice to expert reflects changes in three aspects of performance. First, the professional's working paradigm shifts from reliance on abstract principles to concrete past experiences. Second, the professional shifts from seeing situations as discreet, unrelated parts to seeing situations as part of a whole. Third, the professional's position shifts from detached observer to involved performer. These second generation studies have focused on understanding expertise as complex problem-solving that includes the processes of memory, attention, and reasoning. Second generation studies have also identified novice-to-expert stages of professional development. Holyoak (1991) refers to these studies as developing an understanding of routine expertise, a process in which the professional compiles knowledge into discrete schema that can be recalled quickly within the context of day-to-day professional practice.

Even though previous research clearly articulates a pattern of professional development, "a complete model of expertise acquisition will necessarily require a clear account of human learning mechanisms and their processing limitations, rather than rational analysis alone" (Holyoak, 1991, p. 308). Holyoak believes that third generation expertise theories should "be based on the integration of theoretical ideas drawn from symbolic models (including second generation models of expertise) and connectionist models" (p. 312). These third generation theories will increase our understanding of the connections between expertise, experience, learning, and knowledge complication. The intent of this study was to add to this body of knowledge by exploring the connections between learning and the development of expertise.

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Research Questions

The purpose of this study was to explore the learning processes that underlie the novice-to-expert continuum of professional practice development. Even though previous research identified five stages of professional development (Dreyfus & Dreyfus, 1985; Benner, 1982, 1984; Benner & Tanner, 1987), the intent of this study was to initiate understanding of the learning processes by drawing comparisons between novices and experts, rather than attempting to analyze all five stages.

A qualitative interpretivist approach (Lincoln & Guba, 1985; Guba & Lincoln, 1989) was used to study the following research questions: What different learning processes are used by novice and expert practitioners? How do those learning processes contribute to professional practice development? What factors limit, change or alter the learning process of novices and experts?

Methodology

To explore the research questions of this study, comparisons were made between the learning of novice and that of expert nurses. Ten novice nurses and ten expert nurses served as the purposive sample for this study. Novices and experts were invited to participate in the study while they were attending a continuing professional education program.

Data Collection

Data collection methods included semi-structured interviews and clinical narratives. Semi-structured interviews were used to examine how nurses learned to think in clinical practice. Specifically, the interviews probed how novices and experts acquired new information, how they thought in clinical practice, how they learned from experience, and how they made connections between different clinical cases. Interviews lasted from one to two hours. All interviews were tape recorded after participant permission and human subject approvals were obtained. Confidentiality of responses was maintained and only group results reported.

Additionally, novices and experts were asked to write narratives that described actual clinical cases in which they felt significant learning had occurred. These narratives addressed what was learned, how that learning changed or altered their practice, and how they "learned to learn" in practice. Each study participant received written instruction on how to write a narrative. Narratives completed by study participants ranged from one to four pages in length.

Sampling

The clinical narratives served a dual purpose. First, they were used as a data collection mechanism to triangulate (Lincoln & Guba, 1985; Guba & Lincoln, 1989) the data obtained in the interview process. Clinical narratives were also used to differentiate novices and experts for purposes of comparison in the sample. The participants in this study could not be classified as novices or experts simply on the basis of years of experience or on the referrals of employers or peers. Expertise is

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determined by events that occur in clinical practice and the professional's response to those events. Thus, the clinical narratives served as a representation of the actual practice of the study participants and were analyzed for the three aspects of performance. Clinical narratives were reviewed for: (a) reliance on abstract principles or use of past concrete experiences as paradigms, (b) understanding clinical situations as discrete parts or seeing situations as an integrated whole, and (c) acting as a detached observer or an involved performer (Benner, 1984). Nurses in this sample were classified as novices or experts based on how their clinical narratives demonstrated these three components.

Study participants categorized by this method as novices had between six months and one-and-a-half years of experience. Study participants categorized as experts had between 15 and 34 years of experience. All participants in the sample were female and ranged in age from 23 to 62 years. Participants represented a variety of clinical and nursing practice areas, including hospitals, home care, and long-term care facilities, as well as school, occupational health, and critical care nursing.

Data Analysis

Interview and clinical narrative data were transcribed and analyzed using a modified constant comparative analysis method (Glaser and Strauss, 1973). Data analysis strategies included the use of concept maps, a graphic device for representing concepts, themes and linkages within a framework that focuses on retaining meaning (Novak, 1998; Novak & Gowin, 1984), and a system of category themes. Upon completion of each interview, a concept map was created, representing the major themes and concepts discussed. To create the map, the researcher listened to each tape-recorded interview, identified concepts described by the participant and linkages between major concepts under discussion.

Next, a review of the concept maps yielded a category system for coding the transcribed interview data from novices and experts. A computerized qualitative data analysis software system was used to separate and retrieve data from novices and experts in the sample. The category system and the concept maps allowed the researcher to place the data from novices and experts side-by-side for comparison purposes and helped delineate the distinctions between novice and expert learning.

Quality Control

Two quality control mechanisms were employed in this study. During the interview process, member checks (Guba & Lincoln, 1989) were used at particular junctures as a way to assure the researcher's understanding of the participants' discussion. Member checks were also used to summarize key points in the research with the participants. During data analysis, peer reviewers (Guba & Lincoln, 1989) were asked to provide critique and assistance in making meaning of the data collected. Two peer reviewers were asked for their thoughts and interpretation of the collected data. Peer reviewers indicated that the concept maps created during data analysis demonstrated an effective way to reduce qualitative data without losing the embedded meaning.

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Findings

In general, findings indicated that novice nurses tend to learn through more formal mechanisms, including review of policy or procedures, attendance at continuing education programs, and reading of journals. While novices appeared to learn through a process of concept formation, experts, seemed to use more informal mechanisms, such as consulting with peers and other health care professionals. Experts constructed a knowledge base for themselves in the context of their practice. They obtained information from multiple sources, processed that information through peer-based dialogue, and changed their practice based on the revised meanings they created. Additionally, experts in this study talked about themselves in one of two ways. Some described themselves as "serving their clients" and others as "a resource to my peers." These descriptions were often influenced by the specific role the expert played in the organization and impacted how the expert learned from practice.

Different Learning Processes of Novices and Experts

The results of this study indicated that novices and experts used different learning processes. Novice learning processes (Figure 1) tended to be contingent on concept formation and the impact of fear, mistakes, and the need for validation on that process.

Novices described how they spent a great deal of time "just soaking up information" to form concepts. One nurse said she felt like a "sponge" and continually tried to absorb as much as she could hold. Novices described how they "did not even know what they did not know," so they would tend to "adapt to the ideas of others." "Everything I am learning is new," stated one novice, "so I just take it in and try to remember it." One nurse stated, "You know it's like that movie—just show me the money—well, just show me the procedure! I just need to learn how to do it." In this study, novices described how they were still forming concepts and striving to "sort it all out."

Novices described their learning as a process of concept formation and assimilation. In concept formation, the novice names or labels concepts connecting a given representation to a particular meaning (Novak, 1998; Novak & Gowin, 1984; Ausubel, 1978). They begin to learn in practice as they acquire information and link that information in unique ways. Novices described how they directly assimilated information by striving to link this to "something I had seen." Bereiter and Scardamalia (1993) refer to this as the "best-fit" approach to learning. They explain how novices try to "find the best-fit and go with it, even if the fit is not very good" (p. 169). For example, a novice in this study stated:

> I know (from school) that we are supposed to consider each client an individual, but right now I just try to remember when I go from one client to the next. I ask myself if I have seen any of these medications before. If another client is taking the same med, I try to remember why that first client took it. Usually the reasons are the same.

This concept formation process was then affected by the novice's feelings about the context of their practice. Novices described feeling "overwhelmed," "scared to

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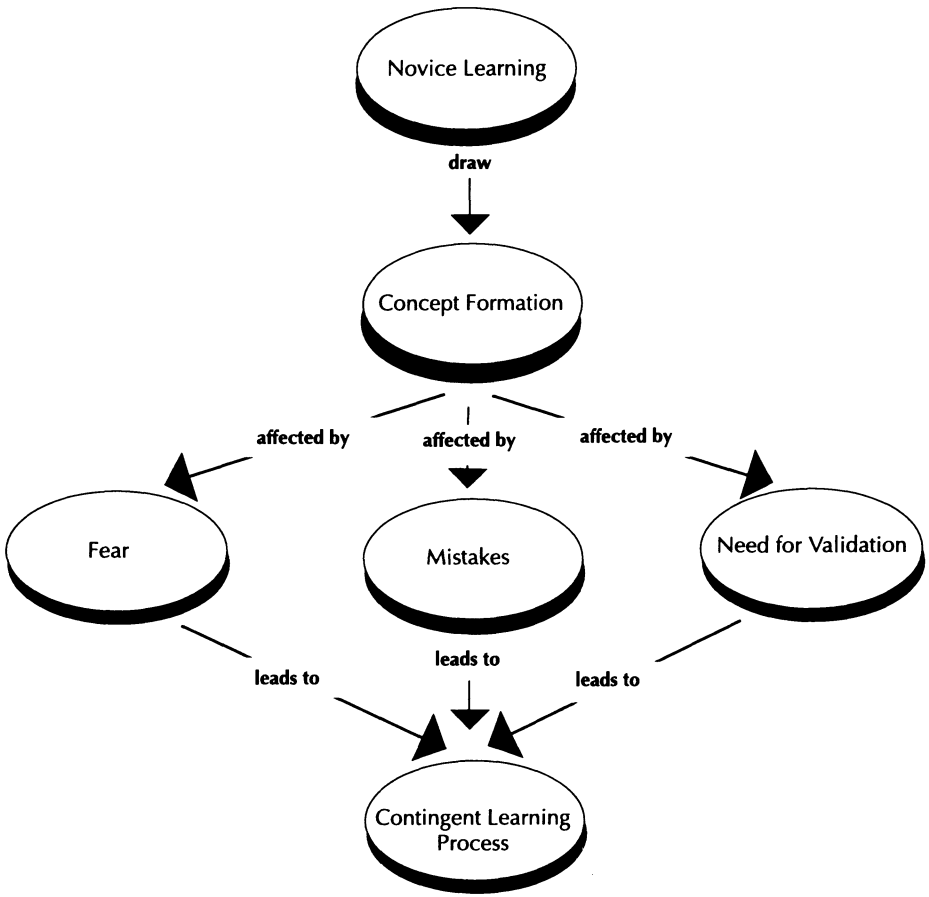

Figure 1: Novice learning processes

death," and "terrified of making a mistake." One novice indicated:

> You are mainly working on fear, fear that you are going to make a mistake. I am just so nervous most of the time. It is a big responsibility, huge responsibility, and I feel so wary, as 'everything' every little thing I need to learn to do. My first few injections, I was sure I was going to kill somebody. It is really scary.

Novices described how they "needed validation" for procedures and ways of acting in their clinical practice. They often described how they would not initiate procedures until other staff had confirmed the appropriateness of the planned action.

Novices used the learning strategies of "asking experts, particularly the physician," "looking it up," and "taking formal courses," but these strategies were used when the novice was directed to do so; they indicated that rather than deciding what to learn they waited to be told. One novice stated, "Sometimes I feel so overwhelmed,

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I just need to be spoon-fed the information." In other words, novice learning in this study was found to be predominately other-directed. One novice described her learning strategies by stating:

> Generally, I would rely on the other staff that are here. Particularly the physicians, they are very helpful in explaining things, telling me what to learn, what is important . . . and also I mean above our desks are a ton of reference books and I look things up there.

Expert learning, on the other hand, tended to be more constructivist and self-directed (Figure 2). Experts solidly grounded their learning in the needs of their clients and the context of their practice. They indicated that they "had a blueprint in their mind[s]" of what their client needed and would make sure they had the information required to meet those needs. Experts also indicated that they would actively learn new information because "that is what I need to know to work here." One nurse practitioner described how she coped with the fact that she was seeing more and more clients in need of pap smears. Since her educational background happened to be in gerontology, she had not developed this particular skill. The learning action she initiated was to arrange time with the OB-GYN nurse practitioners in her clinic so that she could add this skill to her knowledge base, taking a very active role in seeking out the information she needed to provide care to her clients.

Experts also described this active integration of concepts as including their ability to "improvise," to "pick up little things," to "draw on other professional experiences," and to "draw on personal experiences." One nurse stated that when she first started practicing she felt there was only one way to do things. Now she recognized that the best part of her practice was the "art of nursing" and her ability to "create" or "improvise strategies just because I know they will work." She indicated that she learned to do this by developing the ability to "link together experiences in ways that are often hard to describe." Experts indicated that both their personal and professional maturity contributed to being able to "put together the big picture." One expert indicated that it was "all her life experiences" that gave her confidence in her ability.

Experts viewed formal learning opportunities as "background material" that simply "enhanced the knowledge" they had gleaned from reading, library research, and discussion with colleagues. For them, it was "being in the practice that mattered." They described a much more active and self-initiated process than novices. Experts indicated that they would go "searching themselves" for what they needed to learn. One stated, "I am at a point in my career where I really teach myself what I need to know." In this study, experts demonstrated that their learning was a self-directed process similar to that defined by Garrison (1997), who indicated that "an adult learner who is fully self-directed has moved beyond simple task control and has learned to think critically and construct meaning in ill-defined and complex content areas" (p. 21).

Experts also used their experiences in a different way, learning by assimilating new information with their past experiences or by differentiating their experiences from the new information. They primarily learned through a process of dialogue and sharing, going "to the person with the best information, whether the person is a physician or nursing assistant," and then they would "toss around ideas" or "listen

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to what that person knew." One nurse explained that in the home care agency where she worked, each nurse had a desk in a small cubicle. She stated, "Some of my best learning is when I push my chair back, lean around the corner and say to the person next to me—I have a client with thus and so going on, ever run into that?—Then we get into this exchange of ideas that is just great."

Experts described their learning as similar to constructivist learning processes, demonstrating an active creation of their own knowledge base by seeking out and

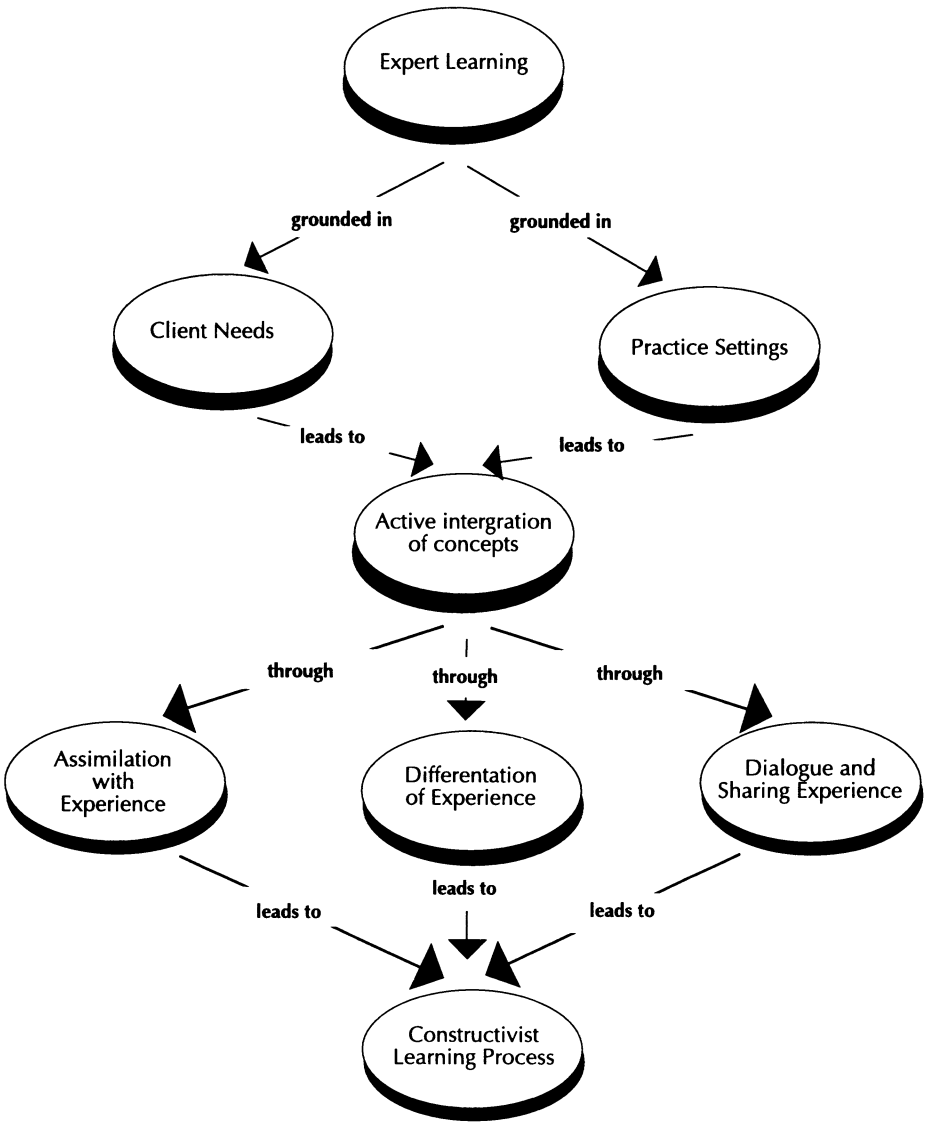

Figure 2: Expert learning processes.

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assimilating new information into their current knowledge base. This process then changed the character and meaning of both the new information and the previous experience because the expert would derive a deeper level of meaning and understanding in the process. Rather than relying on best-fit approaches to learning, experts used a "knowledge-building schema that lends itself to provisional interpretations, open-mindedness, and to active pursuit of fuller understanding" (Bereiter & Scardamalia, 1993, p. 171).

Finally, experts indicated that they felt a great responsibility to learn so that they could share information with colleagues, feeling a need to "give something back to the profession by sharing what [they] know." It was often this feeling of responsibility that motivated experts to search out the most current information on a variety of topics. Experts learned so that they could share and, at the same time, learned within the process of sharing.

Continuum of Novice to Expert Learning

Experts in this study were also asked to compare their learning as novices to that of their present level of expertise. The main theme that emerged from this study was that nurses learned how to go about learning within the context of their practice. Experts indicated that, throughout their career, they had developed strategies and processes that facilitated their learning. For example, one nurse stated:

> What I didn't know as a novice, and what I learned in my career, was how to learn—how to teach myself—that I was capable of finding out anything I wanted to find out because I know the resources, and I'm smart enough to figure it out. I have a lot of confidence that way.

Another nurse indicated:

> Oh, I think when you first get out of school, it is learning from people who had more experience. Just being on the job and having people who have done those things tell you what to do. Now in the position that I'm in here, there is no one but me. I'm the person that is the expert, so I'm the one that has got to find out on my own, and so I'm the one that people come to for that kind of information. I've got to be the one that is kind of teaching myself because I'm responsible for my own learning now.

Participants indicated that in the process of learning to learn or to teach themselves they learned how to decide what was important to them. In the words of one participant, "Instead of listening to everything everybody has to say, I know how to filter it and be more selective." This nurse went on to describe how she sorted information based on past experiences, thus using these experiences as filters to assist her in the learning process. Another nurse described the same type of process by indicating, "When I was a new nurse I wanted to be spoon-fed the information. Now I need that give and take to help me sort out what is important." This process appeared to be one of prioritizing and integrating information.

Finally, study participants described that, as they developed from novices to experts, they moved from being overwhelmed by events to creating a narrow focus for themselves and, finally, to expanding their learning in multiple areas.

> For the four years that I was in school, I learned best by reading and observ-

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> ing. When I first got out of school, I just didn't have an idea of what I needed to learn. I didn't know how to go about learning what it was I did not know, and I learned that I needed to narrow my focus. Then, as time went on I learned to open up that focus.

A major issue identified in this study was the level of insight into the learning process itself; novices did not understand their own learning while experts did understand how they learned, as well as how they created and used knowledge for themselves in the context of their practice.

Factors that Support or Hinder Learning

Novices and experts identified different factors that either support or hinder their learning within the context of professional practice (Figure 3). Novices found that having such formal learning opportunities as nurse educators, textbooks on their units and care conferences supportive of their learning process. One novice indicated, "I think I like a formal way of learning . . . I absorb it better if I just sit in a class." On the other hand, experts unanimously found informal opportunities such as dialogue with colleagues facilitated their learning. "I get my best ideas and learn the most after having a discussion with my colleagues," stated one expert.

When asked to identify contextual factors that hinder learning, novices described specific issues such as insufficient time and in-service education sessions, low staffing, and very specific individuals. For example, one nurse shared her encounter with a clinical supervisor.

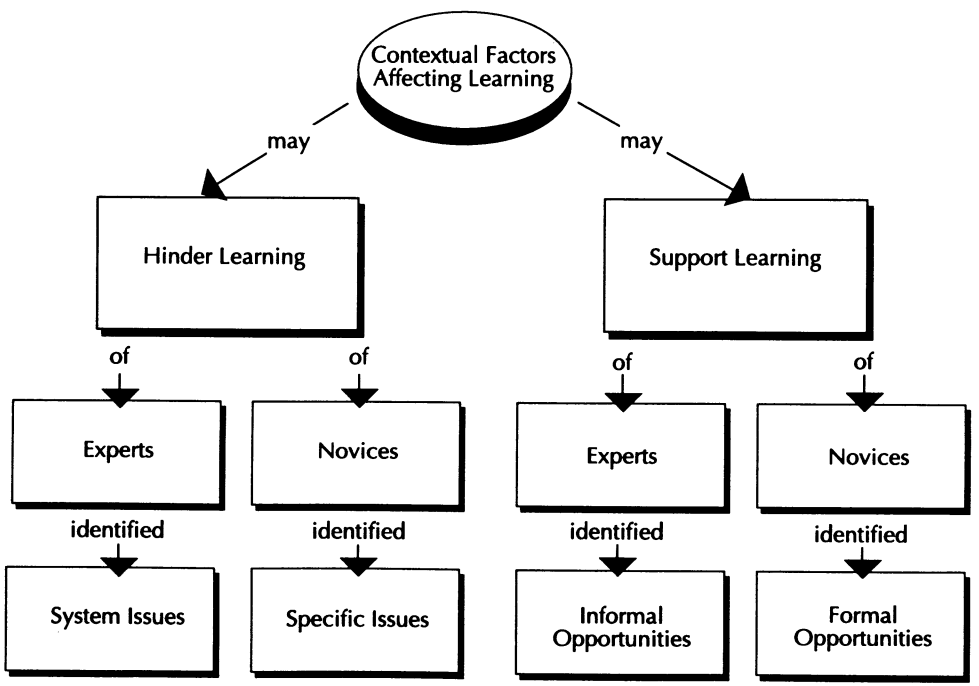

Figure 3: Contextual factors affecting learning

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> One night I had a woman who needed oxygen really quick [sic], and [the supervisor] was sitting right there at the nurses' station looking at the chart. I said to her, "I need to put this woman on oxygen," and I did not know where the oxygen supply cupboard was or anything because I was so new. I thought, I'll just have her help me. So I asked her, and she looked at me and said, "Look it up in the policy book." I did not have time to look it up in the policy book! This woman needed oxygen right away. So I whipped the policy book out and I am slamming it on the counter and I was so upset. She just sat there and that certainly did not help my learning.

Conversely, experts identified systemic issues such as politics, resources, and organizational structure. For example, one expert described how her agency was split into three specialty areas for service provision. She felt that this hindered learning because staff only learned the specialty, had a very narrow focus, and "there was no cross-over. We have set up these artificial boundaries in our practice and thus have restricted not only where we work, but what we learn." Another expert stated, "A roadblock sometimes is people's mind set about how important regulations are; those regulations can get in the way and impede our learning." Experts recognized that they functioned within a system that impacted their learning in a variety of ways, supporting that of Engestrom's finding (1995) which identified that experts not only understand activity systems but that they have the ability to "operate in and move between multiple parallel activity contexts" (p. 319).

Discussion

For the nurses in this study, results indicate that different learning processes, feelings, learning strategies, and relationships to the context of practice underlie novice and expert stages of professional development (Table 1). Whether these findings are applicable to other professions is unknown at present.

Table 1
Comparison of Novice and Expert Learning for Nurses in Study

Dimensions	Novice	Expert
Learning Processes	Contingent Concept formation Best-fit	Contructivist Integration with and differentiation from experience
Feelings	Fearful	Confident
Learning Strategies	Memory Accumulates information	Dialogue Creates knowledge base
Relation to Context of Practice	Understands specific issues	Understands system implications

An important study finding, however, and one worthy of further research in other professions, is that experts appear to have a well-developed awareness of their own

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learning processes and can articulate that they have learned how to learn, learned how to teach themselves, and learned how to construct a knowledge base. Experts in this study knew how to learn from their practice and from their experiences.

Novices on the other hand, did not seem to have an understanding of their own learning processes. They tended to focus on using memory, accumulating information, and waited for others to tell them what to learn. This finding is somewhat surprising, as it is contradictory to the literature in adult education on learning from experience. Dirkx and Lavin (1991) summarized the literature on learning from experience into the FOURthought model, indicating that we come to know about ourselves and our world through the mechanisms of trial and error, rationality and reflection, creative expression, and discernment. Novices in this study used none of these mechanisms for learning from their experience. Novices were too afraid of making a mistake to use trial and error, they did not describe a reflective or creative process nor did they discern the meaning of their experience.

It appears that the findings of this study are consistent with the work of Patel and Groen (1991) who describe medical expertise as consisting of generic expertise, specific expertise, and domain-independent expertise. These different types of expertise include the development of content specific knowledge, as well as knowledge processing skills. They indicate that memory recall appears to reach a "ceiling effect" (p. 117) in physicians after which the expert uses more divergent thinking, learning, and forward reasoning to solve clinical problems.

This raises a number of questions: Does the development of expertise in professional nursing practice rely on the development of expertise in learning? Can expertise in nursing practice develop without a simultaneous development of expertise in understanding one's own learning? Is the change from contingent learning processes to a more constructivist approach at the center of understanding the development of nursing expertise?

Future research in expertise will need to continue the exploration of the different learning processes of novices and experts across a number of different professions. In this study, data have been collected from one group of professionals, and it is not known if novices and experts in other professions would describe similar learning processes. For instance, professions other than nursing might involve fewer, if any, life-or-death decisions. Would this ease the fear of making mistakes, allowing for less "by-the-book" and more trial-and-error learning among novices in other fields? Additionally, future research is needed to understand when the shift from contingent novice learning to constructive expert learning occurs. Are there events in the professional's life that lead to this shift, or is the shift a result of maturational and developmental forces?

Finally, the research-to-practice connections within continuing professional education need exploration. If the development of expertise in professional practice relies on the development of expertise in learning, what implications does this have for continuing professional education? Can continuing professional education programs be developed that foster the development of meta-cognitive, learning-how-to-learn strategies? Can novice professionals learn these strategies in education programs and then apply them in their work contexts, or do learning strategies need to be developed as situated in the context of practice? Again, additional work both

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within and across professions is recommended.

The study of professional expertise has grown from an understanding of serial problem solving, to an understanding of the stages of career development, and now is moving toward developing an understanding of the connections between learning and expertise. The future of this research may well move beyond Holyoak's (1991) call for third generation studies focusing on connections and into a fourth generation of studies that focus on development of collective expertise across various contexts and disciplines.

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