

How Doctors Learn in the Medical Workplace^{a,b,c}

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Abstract This qualitative study examined the self-directed learning activities of physicians in light of several lines of research on how doctors learn. The result is an integrated and expanded theory of learning in clinical practice that carries implications both for the education of physicians-in-training and for physicians' continuing professional development. In particular, the theory points to problem areas in teaching medical students and residents to learn in clinical practice, and in matching the learning needs of physicians to organized Continuing Medical Education activities.

Introduction

A rich literature exists describing physicians' learning. Slotnick, *et al.*, (1997, 1998) and McLaren, Snell, & Franco (1998) have shown that physician learning begins with either *specific problems* (e.g., posed by particular patients) or those involving *bodies of skill and knowledge* (e.g., updates, learning to use new technologies) and that each problem type was associated with a particular form of physician learning. Jennett, *et al.*, (1994), described learning forms as *semi-structured learning* (e.g., available reading and consultation sources) used to resolve specific problems, and *formal learning* (e.g., planned learning projects, courses at specialty society meetings) used to address problems associated with bodies of skill and knowledge. Finally, learning to resolve specific problems results in incremental additions to a doctor's knowledge and skill Fox, Mazmanian, & Putnam (1989) call *adjustments* while learning associated with bodies of skill and knowledge produces *redirections* to larger "elements" of the doctor's life and practice.

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There is a second set of patterns which describes *learning episodes*--the stages doctors move through in going from problems which precipitate learning to learning outcomes. These stages have been described by Geertsma, Parker, & Whitbourne (1982) and Putnam & Campbell (1989) with their work having been pursued by Robert Fox and his colleagues (1997, 1998). Both lines of research point to three stages in physician learning: Doctors deciding to take on a learning task, learning the skill and knowledge anticipated to resolve the problem, and gaining experience using what was learned in a variety of settings.

Two pieces are missing from the learning episode formulations: There is no verification that the three stages make up a *stage theory*, e.g., as proposed by the developmental psychologist John Flavell in 1971, and there is no evidence bearing on whether the three stages manifest themselves in the same ways when the problem precipitating learning is specific vs involves a body of skill or knowledge.

This study addressed three goals in seeking the missing pieces: It integrated and expanded earlier work on physicians' self-directed learning episodes, it demonstrated that the integrated theory of physicians' self-directed learning is in fact a *stage theory*, and it identified limitations associated with the theory. These goals are important because addressing them means (1) advancing our understanding of physician learning in *all* settings (and not just credit-bearing CME), and (2) providing a more accurate picture of CME's role in doctors' continuing professional development. Implicit within (2) are suggestions for improving aspects of needs assessment and documentation of CME's impact on doctors' learning.

Methods

This study was conducted under the auspices of the Royal College of Physicians and Surgeons of Canada's Maintenance of Competence (MOCOMP) program. MOCOMP invited physicians to be interviewed on how they approached their needs for new skill and knowledge. Interviews occurred in their offices using a protocol designed to elicit narratives only; care was taken not to suggest that learning occurred in stages or that types of problems precipitating learning were associated with particular learning approaches. Interviews were reviewed and note made of topics and issues doctors raised (*open coding*) before seeking the way topics and issues varied with each other (*axial coding*) (Strauss & Corbin, 1994).

Results and Discussion

A Description of How Doctors Learn

Thirty-two of the 84 doctors contacted were interviewed and their descriptions of how they learned confirmed both that two varieties of problems precipitated learning episodes (specific problems and bodies of skill and knowledge), and that learning episodes followed stages satisfying Flavell's criteria for a stage theory. There were, however, important additions and modifications to the stages.

First, a fourth stage was added (*Scanning*) in which doctors examined their environments for both problems which *might* precipitate learning and for ideas, proposals, etc., which may be important to them in the future. Second, the study showed that the manner in which the remaining three stages were manifest was a function of the type of precipitating problem. In particular, *specific problems* progressed rapidly and made use of immediately available learning resources while learning associated with *bodies of skill and knowledge* was more deliberate and used resources requiring more planning before they could be accessed (e.g., courses at specialty society meetings). Third, there are clear criteria associated with when the physician satisfied a given stage and whether learning should continue or terminate. The four stages and their manifestations as a function of problem type are shown in Table 1.

Table 1. The 4-stage theory of physicians' self-directed learning episodes.

Learning Stage \ Problem Type	Specific (e.g., addressing a patient need)	Bodies of Skill and Knowledge
Stage 0: Scanning for problems and other interesting things.	The doctor is aware that problems are "out there." The doctor is alert for problems which he might need to solve and, when potential problems are encountered, he moves on to the next stage.	
Stage 1: Deciding whether the potential problem encountered is worth pursuing.	Doctor senses a need for immediate action and decides on the spot whether to take on the problem; alternatively, the doctor reads a bit, talks with others and nevertheless decides quickly.	Doctor feels uneasy ("Maybe I should review that stuff....") and asks: Is this really a problem? Is there likely a solution to the problem? Are resources available so I can do the required learning? Am I prepared to make the changes in my practice required by the learning I do?
Stage 2: Learning what is needed to address the problem.	Learning involves reading (typically journals, less often texts) and talking with others who offer suggestions.	Learning involves comprehensive reading and taking available and appropriate courses.
Stage 3: Gaining experience using what's been learned.	Learning at this point means trying the problem solutions on the problem in question and seeing what happens.	Learning means trying the new skills and knowledge in a range of settings and gaining experience as a result. It also means reading again (and listening to Audio-Digest tapes) though now the purpose is not to learn the new thing but to see what kinds of experiences others have had with it.

Differences among the stages can be understood in terms of each stage's *goal*, the *discrepancy* resolved during the stage (i.e., what's needed to address the goal), the way *learning resources* are used, the *reflection* (i.e., the thinking) the doctor does during the stage, and the *criteria* to be satisfied for the stage to be complete. The criteria are of particular interest because they bear on whether a doctor's

exiting learning episodes before completion of the last stage is justified or unjustified. The stages are compared and contrasted in terms of these attributes in Table 2.

Table 2. Attributes of learning episode stages.

Stage Attribute	Stage 0	Stage 1	Stage 2	Stage 3
Goal	Identify potential problems to consider during next stage AND pick note potentially useful issues.	Decide whether the doctor should learn what is necessary to resolve the precipitating problem.	Learn the knowledge and skill necessary to begin resolving the precipitating problem.	Apply and become comfortable with what has been learned in resolving the precipitating problem.
Discrepancy	Doctor needs problems whose solutions will satisfy Maslowian needs. ³	The doctor lacks sufficient information to decide whether to pursue the problem's solution.	The doctor lacks the skills and knowledge necessary to begin resolving the precipitating problem.	The doctor lacks experience and/ or confidence in what he is doing.
Learning Resources	All aspects of practice and daily life.	Specific problem: The clinical situation, reading, discussion with other doctors. New body of skill and knowledge: Reading, conversations, information at meetings.	For specific problems, primary sources are reading and consultation; for learning new skill and knowledge, they are reading, consultation, and courses.	Primary sources are those used already and experience using the skills and knowledge learned. Doctors also seek others' experiences in similar situations.
Reflection	Focus on probable fit with doctor's life generally, practice in particular. Relationship of problems, information, and issues to practice is a central feature.	Specific problem: Focus on patient, available reading and consultation; context varies from clinical and immediate to consultative and deliberate; purpose is to address the questions under <i>discrepancy</i> . New body of skill and knowledge: Focus on information on skills and knowledge to be learned; context is consultative, deliberative and occur anywhere; purpose is to answer <i>discrepancy</i> questions above.	Specific problem: Focus is knowledge and skill needed to resolve the problem; context is typically clinical and immediate; purpose is to learn procedures for addressing the problem. New body of skill or knowledge: Focus is reading, context is deliberative and/or hands-on; purpose is to gain sufficient knowledge and skill to begin using the new learnings in resolving the precipitating problem.	<i>Post mortems</i> of what happened occurred in both specific problem and general body of skill and knowledge situations. The focus was on the doctor's experience as well as prior knowledge and experiences, the context is deliberative and may or may not be at the site of the action, and the purpose(s) to evaluate and gain experience. The experiences of others (both personal and published) is reflected upon as well.
Criteria for Completion	Problem, issue, or information seems interesting or important enough to be considered further.	Answers realized to the following questions: Is there really a problem? Is there likely a solution to the problem? Are resources available for the physician to do learn what is required to solve the problem? And is it practical for the doctor to do the learning?	Situation-specific indications: The problem requires action, resources were exhausted, others (e.g., instructors) told the physician it was time, there was nothing more to study; doctor specific indications: An acceptable plan existed, the doctor felt ready; the doctor was clear on what was to happen next; the doctor felt there was no value in additional learning.	All criteria were situation-specific in the sense that the doctor gained enough experience to be confident with the new learnings. This was evidenced by the doctor's no longer consciously considering her actions, or the doctor's attention shifting to other issues. The stage could also end because the precipitating problem resolved and the doctor lacked further interest.

Summarizing Thus Far....

Interview data from 32 physicians were collected and interpreted in light of the existing literature on physician learning. This produced the following conclusions:

1. Physicians' self-directed learning activities vary with the nature of the problem which precipitated the learning episode and the stage the doctor is at in resolving the problem which precipitated the learning episode.
2. Stages in self-directed learning episodes are distinguished from one another in terms of their goals, discrepancies, learning resources, reflection, and criteria for completion.
3. Self-directed learning episodes can terminate for reasons which may or may not be justified.

Undergraduate and Graduate Medical Education.

I assert that the best way to improve the quality of learning in clinical practice is to ensure (1) that medical students and residents understand both how they learn and how their learning relates to clinical practice, and (2) that medical students and resident develop self-learning skills appropriate to the learning needs they'll encounter in practice. Potentially the most far-reaching implication of this study is that it offers undergraduate medicine a description of the self-learning behaviors to be taught to physicians-in-training (see Tables 1. and 2.). These behaviors are important because, in contrast to the biomedical knowledge taught to students and residents which is reputed to have a half-life of seven years, these skills will last an entire career. In the alternative, discussion of these skills within the undergraduate, graduate, and continuing professional development communities may show these skills to be sub-optimal for doctors, and in that case, the value of this study will be that it moved forward the conversation on what doctors should be taught about being self-directed learners.

While contemporary (i.e., problem-based) undergraduate curricula focus on development of problem-solving skills, and problem solving requires integration of new knowledge and skills into students' existing knowledge structures (Papa & Harasym, 1999; and Harden & Davis, 1998), these curricula do not consider the ways in which students vs doctors locate, integrate, and use new skill and knowledge. And so the first implication arising from this study is that those responsible for undergraduate medical curricula need to:

1. Decide whether the 4-stage model of self-directed physician learning doctors currently use is what they seek to teach to medical students and residents.

Depending on the answer to (1.), the second implication for medical curricula is:

- 2a. If the answer to the preceding question is 'yes,' then curriculum developers must consider whether current instructional activities teach both (1) problem-solving skills, *and* (2) self-directed learning skills associated with the 4-stage model.

Of particular interest in this regard is the question of whether the criteria physicians use to decide that they know enough to act (see the bottom row of Table 3.) are sufficient to medical students', residents', and physicians' needs. A consideration of these criteria by curriculum developers should address the implications of incomplete data in decision making (see criteria for stage 2. in particular) and the

circumstances under which the trade off of time-saving for completeness is appropriate (Mechanic & Parson, 1975).

It is not clear that learning heuristics used by doctors are used by medical students and residents, and conversely. In an earlier study (Slotnick, *et al.*, 1997), an anesthesiologist told of an heuristic he used in preparing for presentations at rounds: Though locating the skill and knowledge needed to address the specific patient's problem took relatively little time, he persisted with preparation until he was certain he knew enough to fend off the 'pimping' he expected he'd receive. This latter heuristic had the effect of extending--rather than shortening--the stage 2. learning process.

- 2b. If the answer to (1.) is 'no,' then curriculum developers can use the model described here as a jumping off point in identifying the kinds of self-directed learning activities they'd like doctors to develop.

Deciding whether to take on the learning problem (stage 1.) --regardless of whether it is specific or concerns a body of skill and knowledge--is a critical feature of physician learning. Nevertheless, students learning under problem-based curricula are not given the choice of taking on or not taking on a problem--they're simply given problems and told to solve them (Harden & Davis, 1998).^d Thus an important implications of this study is the question:

3. At what point should students be taught to evaluate problems so they can decide whether to take them on once they begin practice?^e Relatedly, what kinds of principles should they be taught bearing on making such decisions and what kinds of experiences will allow them to develop their skills in this important area?

A further implication arising from possible answers to the preceding question is that doctors can decide to take on or not take on learning issues for reasons which are justifiable or not justifiable. One basis for the decision is the likelihood that there is a solution to the problem at hand (see criteria for specific problems, stage 1., Table 3.), and so the Gorman, Ash, & Wykoff (1994) finding that primary care physicians frequently underestimate the likelihood that specific patient problems have solutions carries important implications for physician learning in practice. Ending learning because the doctor mistakenly believe's a problem has no solution is not necessarily a justifiable early end to the learning episode. Thus the next implication from this study is that:

^d Which implies that all medical problems have solutions. King and Kitchener (1992) point out that while this may be the case for well-structured problems, it is certainly not true for ill-structured problems, and this, in turn, raises the question of when and how physicians-in-training learn to deal with these issues.

^e An obvious place for physicians-in-training to learn to make these decisions is residency. I understand that in case of general surgery, residents are to be provided with the "...opportunity...to manage...patients who may or may not require surgical intervention...and to acquire skill in such non-operative management" (American Medical Association, 1998). Note, though, that the emphasis is on residents' learning non-operative management rather than learning how and when to refer the patient.

4. A study of physicians' learning should be undertaken to estimate prevalences of justifiable and unjustifiable early ends to learning episodes and the medical and epistemological circumstances surrounding each episode.

Other implications for curriculum concern the differences in the ways in which medical students, residents, and practicing clinicians use learning resources. More specifically, clinicians tend to use colleagues and readily-available literature (e.g., journals they subscribe to) as information sources in deciding to take on specific problems, learning what is needed, seeing how their experiences using what they've learned applies or fails to apply to the problem at hand. Medical students, in contrast, rely much more on textbooks, a source used infrequently by clinicians. This raises the curricular question of:

5. Where in medical training should the shift from texts to journals occur and how might it be implemented?

Implications bearing on Continuing Medical Education (CME)

This study's findings carry important implications for people concerned with doctors' continuing professional development. These implications include but are not limited to:

CME Needs Assessment. The learning episodes perspective indicates that proper needs assessment information includes (1) the problem the doctor wishes to solve, (2) whether it is specific or concerns a body of skill or knowledge, and (3) the stage the doctor is at in resolving the problem. Focusing on these issues provides much more informative needs assessment data for (1) preparation of instructional activities, (2) description of the population served by CME, and (3) documentation of the impact of CME activities.

Learning Resources at CME meetings. Since specific problems move rapidly, and since resources for solving them rely heavily on journals and discussions among peers, CME meetings can address a range of needs by providing opportunities for dialogs and small group discussions among attendees. Large group sessions, in turn, should be reserved for learning addressing problems dealing with bodies of skill and knowledge.

Evaluation of CME activities. Looking solely at change in practice (Davis, *et al.*, 1995) misses many outcomes arising from CME activities. For example, a doctor may move from one stage to another through participating in CME though this would be noted only if the doctor moved to or through the last stage. Further, if a doctor exits the learning episode for a justifiable reason, there is simultaneously no change in practice and a learning success attributable to the CME activity. Evaluation of CME should examine both stage completion and the reasons for termination of learning.

Further Research

Issues left unresolved by the study include: Documentation of the range of circumstances under which doctors unjustifiably end learning episodes ("learning failures"), and identification of ways doctors know they've finished learning at a given stage. For example, doctors said they knew they were finished learning when they had a plan for resolving the precipitating problem, saw consistency among the

sources of information they were accessing, and so on. These "learning heuristics" function the same way as do diagnostic heuristics in leading doctors to decisions; what needs to be done now is document them and explore how doctors understand the ways in which they function.

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