

How Doctors Learn: Physicians' Self-directed Learning Episodes

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ABSTRACT

Purpose. To qualitatively examine the self-directed learning activities of physicians in light of several lines of research on how doctors learn.

Method. Under the auspices of the Royal College of Physicians and Surgeons of Canada, the author elicited from physicians narratives about past learning experiences. He analyzed the narratives (1) seeking themes among the doctors' approaches and (2) examining those themes in light of the existing literature.

Results. The 32 physicians interviewed described learning experiences, confirming earlier research that two varieties of problems (specific and general) precipitate learning and that learning episodes follow definite stages: scanning for problems, deciding whether to pursue the

learning task, acquiring new knowledge and skill, and gaining experience with what has been learned. The latter three stages have been described previously and are expanded upon here.

Conclusion. This study produced an integrated and elaborated theory of learning in clinical practice with implications for both the education of physicians in training and 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.

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A rich literature describes the ways that physicians learn. Several groups of researchers have independently confirmed that physicians are motivated to begin learning either by *specific problems* (e.g., questions raised about particular patients) or by *general problems* (e.g., gaps in skills and knowledge caused, say, by updated techniques and new technologies) and that each problem type is associated with a particular form of learning.¹⁻³ Jennett and her coworkers,⁴ in summarizing the existing literature, described learning forms as either *semi-structured* (e.g., using readily available journals and colleagues), which appear to be used to resolve specific problems,

or *formal* (e.g., planned learning projects, courses at specialty society meetings), which are associated with learning more general bodies of skill and knowledge. Finally, the semistructured learning that resolves specific problems results in incremental changes to a doctor's knowledge and skill, which, I believe, Fox, Mazmanian, and Putnam⁵ would call *adjustments*. In contrast, the formal learning associated with general problems produces *redirections* to larger "elements" of the doctor's life and practice (see Table 1).

A second line of research describes *learning episodes*—the stages that doctors move through in going from the problems that precipitate learning to the outcomes of that learning. These stages were originally described by Geertsma, Parker, and Whitbourne⁶ and Putnam and Campbell⁷ (with their work having been pursued by Robert Fox and his colleagues^{8,9}) as the *learning and change model*.⁵ This research pointed to three stages in physicians'

learning: (1) deciding whether to take on a learning task, (2) learning new skills and knowledge, and (3) gaining experience by practicing what was learned.

There are two pieces missing from the learning-and-change model. There is no verification that the three stages indeed make up a *stage theory* (e.g., as proposed by the developmental psychologist John Flavell in 1971¹⁰), and there is no evidence bearing on whether the three stages manifest themselves in the same ways when the problem precipitating the learning is specific versus general. (Note that, as a developmental psychologist, Flavell theorized about human development; I have modified the attributes he seeks in stage theories to apply to the more short-lived nature of learning episodes.)

Flavell¹⁰ listed three attributes that stage theories must have. First, the stages must be qualitatively different from one another. In this case, when doctors move from one stage to another,

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they must shift their way of viewing the learning situation. Second, stages must occur in an invariant sequence regardless of whether all stages are completed. Finally, the movement from one stage to the next is abrupt and discontinuous in terms of what is taking place. I anticipate that the nature of the abruptness and discontinuity will be related to issues such as the variety of the precipitating problem and the learning forms used, since Jennett and colleagues' work⁴ showed that semistructured learning activities resolve acute learning problems while formal learning activities require greater commitments of time and other resources. Michael Eraut¹¹ made a similar point in discussing the nature of the reflection occurring during "hot action" (e.g., solving a specific problem) versus situations where the reflection is more deliberative (e.g., addressing a body of skill or knowledge).

In seeking the missing pieces, I sought to integrate and expand earlier work on physicians' self-directed learning episodes, to determine whether the integrated theory of physicians' self-directed learning is in fact a stage theory, and to identify limitations associated with the theory. By doing so, I hoped: (1) to improve our understanding of the continuum of physicians' learning from informal, self-directed learning activities through formal, organized credit-bearing continuing medical education (CME); (2) to paint a more accurate picture of CME's role in doctors' continuing professional development; and (3) to pursue further the ways in which undergraduate and residency curricula prepare doctors to be self-directed learners.

METHOD

This study was conducted under the auspices of the Royal College of Physicians and Surgeons of Canada's Maintenance of Competence program (MOCOMP) and was approved by the

Table 1

Synthesis of Problems Precipitating Learning, Forms of Learning, and Learning Outcomes		
Problems precipitating learning ¹⁻³	Specific problems. The physician focuses on a problem specific to an individual patient and seeks answers in clinical medicine, research, legal medicine, public health, etc. Although the physician may learn something that ultimately has more wider applicability, generalizable knowledge is not the primary motivation.	General problems. The physician focuses on filling a gap in knowledge and/or skill that can be used in a variety of situations. While the physician can identify examples of how the learning might be used, the learning was not precipitated by a specific case.
Form of learning ⁴	Semistructured learning. The physician encounters unanticipated specific problems and so learning is necessarily done <i>ad hoc</i> . To answer this "acute need" for skill and knowledge, the physician must learn using immediately available resources such as knowledgeable colleagues and journals the doctor receives.	Formal learning. The physician recognizes and anticipates ways to address a gap in knowledge and skill. The physician's learning activities may be individual (e.g., planned learning projects) or involve groups (e.g., courses taken at professional meetings or elsewhere).
Learning outcome ⁵	Adjustments. The physician learns incrementally; she actively assesses the disparity between her current capabilities and the knowledge and skill needed to address the specific problem. She is also limited by time and immediately available resources. When this learning activity has challenged the doctor's ability to address more general needs, it may be associated with positive affect.	Redirections. The physician adds to, subtracts from, or changes "a major element of [his] life or practice." Such learning results not only in new skills and knowledge, but also in changes to the perspective the doctor has about the potential utility and application of what he has learned, and so is accompanied by "moderately to strong positive feelings."

University of North Dakota Institutional Review Board. MOCOMP offers physicians the opportunity to use learning portfolios to document their learning, whether as part of credit-bearing CME or as independent learning. MOCOMP invited 84 physicians from communities where large numbers of MOCOMP diarists practiced to be interviewed on how they approached their needs for new skills and knowledge. Doctors who received invitations

were split about evenly between diarists (all diarists in the community were invited) and a random sample of non-diarists. My plan was to continue interviewing physicians until reaching theoretical saturation¹²—that is, until I ceased to learn anything new and of import from the doctors interviewed.

I interviewed doctors in their offices using a protocol designed to elicit narratives while avoiding suggestions that learning occurs in stages or that dif-

ferent types of learning problems are associated with particular learning approaches (copies of the interview protocol are available from me). I then reviewed the audiotaped interviews seeking topics that the doctors raised (open coding¹²) and categorizing those topics into groups before seeing how the categories related to one another (axial coding¹²). I used an outline as my database for organizing the topics within categories and for exploring the relationships among the categories. I added to and modified the outline as I collected the data and afterwards as I reflected on the topics and their interrelationships.

RESULTS AND DISCUSSION

Sample

Thirty-two of the doctors contacted agreed to be interviewed, and I reached theoretical saturation while interviewing the last eight doctors. Four of the 32 were women, two doctors were 30 to 39 years old, 14 were 40 to 49, ten were 50 to 59, and six were 60 or older. One was single, 29 married, and two divorced; 18 had one or more children at home under the age of 18. Ten physicians had fewer than ten years of experience in their current specialties, 11 had between ten and 19 years experience; five had 20 to 29, and six had 30 or more years' experience. Finally, 24 had university appointments, and 20 had received their MD degrees from Canadian schools.

Eleven of the physicians were psychiatrists, six were in internal medicine and its subspecialties, three specialized in obstetrics and gynecology, and there were two each in geriatrics and ophthalmology. The sample included one doctor each from community medicine, dermatology, medical microbiology (a medical specialty in Canada), occupational medicine, pediatrics, and radiology.

Findings

The respondents' descriptions of how they had learned confirmed both that two varieties of problems had precipitated learning episodes (specific problems, such as one psychiatrist's modifying minimum dosages of a patient's medication to prevent movement disorders, and general problems, such as another psychiatrist's learning to use a new class of neuroleptics), and that learning episodes followed stages that satisfied Flavell's criteria for a stage theory.¹⁰ More specifically, the doctors' thinking varied from stage to stage (described below and illustrated in Table 3), I found no instance where the stages failed to follow the same order (including those where learning ended before the third stage was reached), and the movement from one stage to the next was abrupt, as can be seen in the examples in the Appendix.

There are, however, important additions and modifications to the stages described in the introduction to this article. First, I added a fourth stage (Stage 0, *scanning*), in which doctors examined their environments both for problems that *might* precipitate learning and for ideas, proposals, etc., that they filed away because they might be important to them in the future. Second, the study showed that the appearance of the remaining three stages varied as a function of the type of precipitating problem. In particular, learning in response to specific problems progressed precipitously and made use of immediately available resources, while learning associated with general problems was more deliberate (and thus slower) and made use of resources requiring planning before they could be accessed (e.g., courses at specialty society meetings). Third, the doctors behaved as if each stage had clear though unstated criteria that must be addressed in deciding whether to continue or stop learning. The four stages and their manifestations as a function of problem type are shown in Table 2.

I found it easiest to compare and contrast stages in terms of each stage's *goal*, the *discrepancy* resolved during the stage (i.e., the difference between the current state of the doctor's knowledge and skill and what the doctor needed to know and do to realize the goal), the way *learning resources* are used, the *reflection* (i.e., the thinking) that the doctor does during the stage, and the *criteria* to be satisfied for the stage to be complete (Table 3). The criteria are of particular interest because they bear on whether a doctor is justified in exiting her learning episode before she completes the last stage.

Indeed, several doctors described learning events that they had ended before completing the third stage. In one instance, a gynecologist investigated whether to learn how to use pessaries to treat urinary incontinence (stage 1, evaluating the problem), but he decided against continuing on to stage 2 (learning the skills and knowledge) because he was in his sixties and would not have sufficient time to become experienced with the therapy by the time he retired (i.e., to complete stage 3, gaining experience). His decision to end that learning episode was thus justified given the resources available to him (i.e., insufficient time and the small number of incontinent patients in his practice for whom pessaries would be appropriate).

In contrast, a psychiatrist elected not to learn to use MOCOMP diaries because he believed the program was the Royal College of Physicians and Surgeons' attempt to monitor his practice of medicine. Since this represented his misunderstanding of the program, his decision not to learn to use the MOCOMP diary was not justified. In both this case and the case of the gynecologist—indeed, in all cases where doctors ended their learning before completing stage 3—the doctors returned to stage 0.

I need to draw attention to two aspects of the information in Table 3. First, there is a marked difference dur-

Table 2

The Four-stage Theory of Physicians' Self-Directed Learning Episodes, by Problem Type		
	Specific Problems	General Problems
Stage 0: scanning for potential problems	The physician is aware that problems are "out there" and alert for problems that she might need to solve; when she encounters them, she moves on to the next stage.	
Stage 1: deciding whether to take on the problem	The physician senses a need for immediate action and decides on the spot whether to take on the problem; alternatively, she reads a bit, talks briefly with others, and decides quickly.	The physician feels uneasy about a gap in knowledge or skill 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?
Stage 2: learning the required skills and knowledge	The physician reads (journals she receives, less often texts) and consults with experienced colleagues.	The physician reads comprehensively and takes available and appropriate courses.
Stage 3: gaining experience	The physician applies the learned solution to the problem and sees what happens.	The physician tries the new skills and knowledge in a range of settings and gains experience as a result. She also continues to read, although the purpose is not to gain new skills but to see what kinds of similar experiences colleagues have had.

ing stage 1 reflection for specific versus general problems. More specifically, when a doctor first senses that a patient has a specific problem, she decides to take it on so precipitously that she has little time to contemplate her actions. This is much like the situation described by Elstein, Shulman, and Sprafka,¹³ where doctors entertain diagnostic hypotheses within seconds of meeting the patient. I have the feeling that the decision is made on the basis of a "feel" the doctor has for the problem and the circumstances surrounding it. Indeed, it was clear to me that asking "how did you know it was appropriate to take on this learning problem?" put respondents in the position of having to

reconstruct verbally something they did preconsciously. A metaphor I find useful here is that of the doctor having an expectation for what she'll find in dealing with the patient, and that expectation has many "default conditions" associated with it; thus, in encountering a specific problem, the doctor (in essence) is saying "unless I find reason to change any of the defaults, I can proceed with this problem in a routine way."

The second aspect of particular interest is the criteria physicians use to end learning during stage 2, the stage in which doctors learn the skills and knowledge needed to address the problem that precipitated the learning epi-

sode. In handling a specific patient care problem, the doctors frequently had access to several hundred pages of journal articles, many colleagues to offer advice, books, and (less often) professional meetings where additional information might be found. Yet the doctors found answers to their questions in time frames that were relatively short; clearly, they all-but-always stopped their searches for new information well before their information sources were exhausted. The basis for stopping the search was a series of *learning heuristics*, that is, general principles doctors use to know when they've learned enough to end the search and begin the next stage of the learning episode.

The heuristics that the doctors used to end stage 2 were particularly interesting both for their logic and for their potential to create problems. The doctors were comfortable ending the search for new information, for example, (1) if the information they located provided a plan for what to do next, (2) if they received consistent information from different sources (e.g., different journal articles, or a journal article and a colleague), (3) if the information they located allowed them to understand what was causing the problem, (4) if external constraints demanded action (e.g., the situation was emergent—see "a life-threatening infection" in the Appendix), and (5) if the doctor already had an idea of what to do and found out that others had reached the same conclusion regarding the problem at hand.

In each case, the heuristic's underlying logic is clear (e.g., if one finds consistent information, further searching will be likely to turn up more consistency), though, in each case, the potential for mischief is also evident. When I asked doctors how they had come to use these heuristics, their answers implied that adoption of the heuristics was not conscious as much as it was practical; they did it at some point, they were satisfied with the outcome, and so they continued using it. They also re-

Table 3

Attributes of Each Stage in a Learning Episode				
	Stage 0: Scanning for Potential Problems	Stage 1: Deciding Whether to Take on the Problem	Stage 2: Learning the Required Skills and Knowledge	Stage 3: Gaining Experience
Goal	To identify potential problems AND to note resources that might be useful in the future.	To decide whether to learn what is necessary to resolve the precipitating problem.	To learn the knowledge and skill necessary to begin resolving the precipitating problem.	To apply and practice what has been learned in resolving the precipitating problem and related problems.
Discrepancy	The physician needs problems to solve or satisfy Maslowian security, affiliation, and self-esteem needs. ¹³	The physician lacks sufficient information to decide whether to pursue the problem's solution.	The physician lacks the skills and knowledge necessary to begin resolving the precipitating problem.	The physician lacks experience with and/or confidence in what he is doing.
Resources	The physician reviews all aspects of practice and daily life in light of prior experience.	Specific problems: the physician looks to his clinical situation, reads available literature, discusses with colleagues. General problems: the physician reads broadly (e.g., journals available through the medical library), converses, and seeks information at meetings.	Specific problems: the physician reads available literature, and consults with colleagues. General problems: the physician reads broadly, consults, and takes courses.	In addition to the sources he has used already, the physician practices what he has learned and learns from other physicians' experiences in similar and related situations.
Reflection	The physician considers how problems fit her life generally and her practice specifically. She reflects on how problems, information, and issues relate to her practice.	Specific problems: the physician focuses on the patient and on immediate available reading and consultation; reflection varies from clinical and immediate to consultative and deliberate. General problems: the physician focuses on skills and knowledge to be learned; reflection is consultative, deliberative, and occurs whenever the doctor has time to consider the issue.	Specific problems: the physician considers what knowledge and skill she needs to resolve the problem; reflection is typically clinical and immediate. General problems: the physician reads, attends courses, consults colleagues; does hands-on learning; reflection is deliberative.	For both specific and general problems, the physician conducts a "post mortem." The physician focuses on her experience, prior knowledge, and experiences, as well as the experiences (both personal and published) of colleagues; reflection is deliberative and may or may not be at the site of the action.
Criteria for completion	The physician feels that the problem, issue, or information is interesting or important enough to consider further.	The physician answers the questions: Is there really a problem? Is there likely a solution to the problem? Are resources available to learn what is required to solve the problem? And is it practical to do the learning?	Criteria specific to the precipitating problem: The problem requires action, resources were exhausted, others (e.g., instructors) told the physician it was time to act, there was nothing more to study. Criteria the doctor employed: 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 specific to the precipitating problem in the sense that the doctor gained enough experience to be confident with the new learning. This was evidenced by the doctor's no longer consciously considering his 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.

ported never having discussed methods for ending learning episodes before.

I have made no observations in this report on the role affect plays in physicians' learning. While Fox, Mazmanian, and Putnam described affect as varying as a function of type of learning (e.g., adjustments and redirections),⁵ and my interviews suggested that affect varies within the learning-episode stages (e.g., finding a discrepancy can be unsettling to a doctor, while resolving it is satisfying), I suspect that affect also depends on issues such as the seriousness of the problem that precipitated learning. I did not focus on affect in this study, and so describing its role is a task for a subsequent study.

Implications Arising from the Study

My goals in this study centered on improving our understanding of physicians' self-directed learning activities. If self-directed learning is important (that is, if it contributes to doctors' abilities to address their patients' needs), then helping students and practicing clinicians become better at self-directed learning is also important. The implications that follow point to areas in which such improvements might be made.

Two interesting and important sets of implications can be drawn from this study, the first set dealing with undergraduate and graduate medical education. 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, these curricula do not consider the ways in which students—in contrast to doctors—locate, integrate, and use new skill and knowledge.^{14,15} And so the first implication arising from this study is that:

1. Those responsible for undergraduate medical curricula must decide

whether the four-stage model of self-directed physician learning (i.e., the kind of self-directed learning doctors currently use) is what they seek to teach to medical students and residents.

The second implication of this study for undergraduate and postgraduate medical curricula depends on the answer to implication 1. If that answer is "yes," then:

2a. Curriculum developers must consider whether current instructional activities teach both clinical reasoning skills and self-directed learning skills associated with the four-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 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.¹⁶

It is not clear to me whether doctors use the same learning heuristics as do medical students and residents. In an earlier study,² an anesthesiologist told of a 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 (i.e., stop learning when you're confident you can answer the questions you'll be asked) had the effect of extending—rather than shortening—the stage 2 learning process.

If the answer to implication 1 is "no," then:

2b. Curriculum developers can use the model described here as a jumping

off point to identify 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 general—is a critical feature of physicians' learning. Nevertheless, students learning under problem-based curricula are not given the choice of taking on or not taking on the case represented by the problem; they're simply given case-based problems and told to solve them.¹⁷ This is an important issue because expecting students to find solutions to every paper case implies that they are trying to resolve all medical problems they encounter. King and Kitchener¹⁷ pointed out that while solutions may well exist for well-structured problems, it is certainly not true for ill-structured problems; this, in turn, raises the question of when and how physicians in training learn to deal with these issues. Second, students participating in problem-based curricula do have the opportunity to identify and decide to take on learning issues. It will be interesting to know (1) how these opportunities to learn are similar to the self-directed learning approach described here, and (2) how students will decide to take on or not take on patient care problems they will encounter in practice. Thus an important implication of this study is that:

3. Educators must decide when to start teaching students how to evaluate cases so that, once the students start clinical care, they can decide which cases to take on.¹⁸ Educators must also determine what principles bear on making such decisions and what experiences allow students to develop their skills in this important area.

Along these same lines, doctors can decide to take on or not take on learning issues for reasons that 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, and Wykoff¹⁹ 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 believes 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

4. Researchers should study physicians' learning to estimate prevalences of justifiable and unjustifiable early ends to learning episodes and the medical and epistemologic circumstances surrounding both categories of episodes.

Other implications for curricula 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.^{20,21} Medical students, in contrast, rely much more on textbooks, a source used infrequently by clinicians. This raises the curricular concern that:

5. Educators must decide when in medical training the shift from texts to journals occur and how to implement the shift.

This implication is important because, in contrast to the biomedical knowledge taught to students, which is reputed to have a short half-life, these learning skills will last an entire career.

The second set of implications bears on physicians' CME activities. *Needs as-*

essment (activities designed to identify topics of importance to physicians who might attend CME sessions) typically arise from doctors' being asked what topics or issues they'd like covered. Because this study and those cited earlier suggest that the functional unit of learning for physicians is not the *topic* but the *problem*.¹⁻⁴

6. A proper needs assessment must collect information about (1) the problems doctors wish to solve, (2) the type of problem (specific or general), and (3) the stages doctors have reached in resolving the problem.

Focusing on these issues provides much more informative needs assessment data for preparation of instructional activities, a description of the population served by CME, and the basis for documentation of the impact of CME activities. Indeed, documentation should necessarily look beyond change in clinical practice. Since doctors can exit at varying stages in learning, and since early exits can be either justifiable or unjustifiable:

7. Researchers who document the success of continuing professional development activities must consider both the physicians' movement from one stage to the next and whether their early exits can be justified.

Limiting documentation of CME success to the appearance of changes in clinical practice not observable until stage 3²² underestimates the impact of CME learning in practice.

Finally, there is a strong implication here for the types of problems that can be considered at formal continuing professional development activities. While CME sessions already address general problems that deal with bodies of skill and knowledge, they might also address specific problems—those rapidly developing problems that rely heavily on readily available resources—by provid-

ing attendees with opportunities to discuss in small groups specific issues of current interest. Thus the final implication is:

8. Continuing professional development activities should offer participants different learning formats depending on the natures of the participants' learning problems and the learning needs associated with the stages they have reached in the learning episodes.

Limitations of the Four-stage Model

There are a variety of issues raised but not addressed by this study. Most important among them is documentation of the circumstances under which doctors unjustifiably end learning episodes, with cataloging the variety of criteria doctors use to know when to end each stage in the learning episode running a close second. Documentation of both issues would necessarily have to be followed by a careful consideration of the impacts of these learning heuristics on both the perspective they confer on doctors who use them and how medical practice is affected by the heuristics' use.

Another issue needing further investigation is the differential use of learning resources across types of learning problems and learning-episode stages. This kind of information will be especially useful in helping medical students and residents learn the self-learning skills they will rely on when they learn in clinical practice.

Finally, there is the much larger question of examining physicians' learning—both self-directed and formally organized—across the continuum from medical school through practice. In simple language, replication of the kind of study I've reported is necessary, both to confirm that the findings are not peculiar to the 32 physicians I interviewed, but also to see how the experiences of practicing clinicians differ from those of medical students and res-

idents. A cross-sectional study will be a quick fix, but doing a longitudinal study of how medical students *cum* residents *cum* practicing clinicians approach learning will allow examination of variables such as how the learners' epistemologic views affect learning outcomes across the continuum from medical school through medical practice.

I wish to end with a personal note. I've found this study to be one of the most rewarding activities I've been privileged to do; indeed, it is second only to the teaching I do as a source of personal and professional satisfaction. The doctors I interviewed were all committed clinicians who valued the opportunity to reflect on how they approached learning; their reflections were wonderfully candid, our interviews wonderfully productive. I anticipate that colleagues undertaking the kinds of studies sketched in the preceding two paragraphs will find similar satisfactions.

CONCLUSIONS

Given the materials and methods described here, I have arrived at the following conclusions.

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

I have also presented implications of these findings with particular emphasis on medical curricula and continuing professional development

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(Appendix starts on page 1114)

APPENDIX

Examples of Learning Episodes

These examples, prototypical of the learning episodes described by the doctors I interviewed, display well the characteristics of learning episodes. I have chosen them as examples because the problems that precipitated these learning episodes are readily understandable to the broad range of readers who might be interested in this article. I have changed details of these stories to obscure the identities of the physicians, though I have left intact all aspects bearing on their learning. Following each learning episode is a table summarizing it in terms of the attributes of learning episodes presented in Table 3.

The Patients are Unhappy: A Problem Concerning a General Body of Skill and Knowledge

Background. Patients on chronic anticoagulant therapy used to be hospitalized for a few days before surgery while they were weaned from those drugs and then for a few days afterwards while their anticoagulant therapy was restarted. Now, with same-day surgery and the denial of hospital stays, the management of anticoagulants has had to be reconsidered.

Dr. K needed to learn how to manage such patients. This meant (1) distinguishing patients on anticoagulant therapy whose medications could be stopped and restarted from those who simply needed to be hospitalized, and (2) being able to explain to the former group of patients and their families that anticoagulant therapy can be briefly interrupted with minimal risk. Dr. K anticipated that communicating this could be very hard, especially if the patient had been hospitalized previously for surgery and had experienced the stopping-and-starting routine.

Dr. K had learned about anticoagulants in medical school, first encountered them in residency, and, as a general internist, had patients on anticoagulant therapy who had required surgery. He regularly updated himself on anticoagulants' evolving use. Questions motivating his updates included: "What is everyone else doing?"; "What's indicated; what's not?"; and "What will the patient accept?" Trusted colleagues had told him that, most of the time, the medication could be

stopped right before surgery with no problem, but he still felt the need to review the latest literature in anticipation of patients who were special cases or who simply needed reassurance. This is likely to happen when the patient's problem is such that the solution to the anticoagulant question "is not totally evidence-based—you go back to see if there is any more evidence." This means that the nature of the material covered is important (RCT-based findings are more compelling than other kinds of information such as opinions), especially if treatment plans do not work.

Learning activities. To update his knowledge, Dr. K used methods that he had comfortably used before. He searched Medline, reviewed the abstracts, and then read those articles that were either recent or especially relevant. He also talked to colleagues, both hematologists (though it is general internists who manage such medications at his hospital) and surgeons, asking them how they felt about operating on patients who used anticoagulants.

The articles helped Dr. K appreciate that stopping and then restarting anticoagulant therapy immediately after surgery is a reasonable thing to do; that is, most patients do quite well on that regimen. His conversations with the hematologists and surgeons assured him that they have no difficulty stopping and then restarting the meds. Those conversations also allowed him to see their different perspectives: because hematologists and surgeons do not deal with perioperative medicine, they spend little time thinking about how to explain things to patients—that remains a problem in the domain of general internists.

Dr. K reported that he might consider attending a session on anticoagulants at an internal medicine convention, though he certainly would not attend the entire meeting for just that one session. He might also discuss anticoagulants informally with colleagues at other meetings, but he would not seek out such discussions, or contact more experienced colleagues elsewhere because local colleagues were easier to access ("If it's there you use it," he reported). He could have but did not ask a resident to present on the topic and then avail himself of the collected liter-

ature. He reported that textbooks were not useful to him since they are not as up-to-date as articles (he sometimes looks into texts if he wants a historical refresher).

How did he know when he had learned enough? He reported that he had "a feel for what you can do in most of the cases—as long as you have a plan you can feel comfortable with and you don't feel uneasy treating the patient." The plan he developed felt comfortable to him; he felt he could use it with his patients.

What he learned. The hematologists and surgeons with whom Dr. K consulted were "pretty lackadaisical"—they didn't think twice about briefly stopping anticoagulant therapy during surgery. He agreed with their practices, but wondered how he could explain them to his patients and their families, especially to a patient who had been taking the medication "religiously." And although the cases he had where problems did occur—where the patient did develop clots and get into trouble—were unusual events, they nonetheless raised issues that, in his mind, needed to be considered.

Dr. K arrived at plans for how to deal with anticoagulants ("individualize it to each patient's particular case but you can still stop the anticoagulants and then restart them") and how to talk with patients and their families about interrupting the medication. He also felt reassured.

What happened when he applied what he learned? The first patient Dr. K worked with after updating his knowledge of anticoagulants was a woman who had had a problem with recurrent clots ten years before. The family, very leery of what he proposed, was "quite anxious" and "sort of demanded a hospital bed" as the patient had had the last time she had surgery. However, this was not possible ("there was no real indication"), especially since the surgery was elective. Dr. K showed the patient and her family the literature and let them know that the surgeon agreed with the plan. Still, the patient and her family remained uncomfortable with stopping and then restarting anticoagulation; and so the surgery was never performed.

Other patients of his, in contrast, were "fine with it" and agreed to the proce-

cedure. Interestingly, one patient needing a replacement heart valve elected to pay for home-administered, injectable low-molecular-weight heparin, which Dr. K had learned about in his literature review and conversations with the hematologists; this drug, though not paid for by the patient's drug plan, nonetheless cost less than an uncovered hospital stay.

On reflection. Dr. K still talks to hematologists and surgeons about problems, but does so aware that their perspectives are different from his and that they may not understand the complexity of his communications with patients. If he encounters a comparable learning problem in the future, he will do the same things: find out what others are doing (by talking with hemato-

logists and surgeons) and read articles looking for up-to-date information.

A Life-threatening Infection: A Problem Concerning a Specific Patient

Background. Dr. S was the ophthalmologist on call one weekend when a 60-year-old woman was admitted to hospital with

Table A1

<i>Summary of The Patients Are Unhappy</i>				
	Stage 0: Scanning for Potential Problems	Stage 1: Deciding Whether to Take on the Problem	Stage 2: Learning the Required Skills and Knowledge	Stage 3: Gaining Experience
Goal	To seek potential problems for his practice.	To determine whether he could learn what was needed to convince his patients to try the new perioperative anticoagulant regimens.	To know how to prepare patients on anticoagulants—and their families—for surgery.	To gain experience working with such patients and their families.
Discrepancy	This seemed like something where more information would allow Dr. K to make an informed decision about whether to pursue the problem.	Dr. K recognized a disconnect between what his patients expected (to stay in the hospital and have their anticoagulant therapy monitored) and what the hospital wanted (to briefly interrupt anticoagulant therapy during surgery and then send the patients home).	Dr. K did not feel he had the knowledge to know how to deal with these patients and their families under the new surgical policy.	Dr. K knew that some patients and their families would not be comfortable stopping anticoagulants while others would if they understood the issues involved, and he needed experience working with both groups.
Resources	Reading, conversations with other physicians, patients' questions, professional meetings.	Prior experience with patients and announcements of new hospital policy.	Reasonably unhurried literature searches and talks with colleagues.	Experience; the more Dr. K worked with such patients, the better he became at working with them.
Reflection	This seemed like something Dr. K needed to consider.	Dr. K could see the new policy as a potential problem because it ran counter to the expectations of patients and their families.	Dr. K looked at what he learned from his perspective and from the perspectives of the patients (and their families') and of the hematologists.	Dr. K considered how each patient's situation was unique and used his knowledge and skill to make the patient comfortable with the new plan.
Criteria for completion	Dr. K identified a discrepancy between the hospital's policy and his practice regarding preparing patients on anticoagulants for surgery.	Dr. K recognized a problem, considered it solvable, believed learning resources were available, and wanted to change his practice.	Dr. K learned enough to develop a plan he could use with patients and their families. He also felt comfortable with the plan.	He now comfortably takes patients off anticoagulants and has a good idea of how patients will respond. He is also comfortable discussing these issues with patients and their families.

intense pain in her right eye. Because the patient reported a slight decrease in vision, and because Dr. S thought he detected a particular pupil defect, his differential diagnoses included deep venous thrombosis and *Mucor mycosis*, a fungus that attacks the blood supply, first destroying vision and then, after invading the brain, killing the patient (the mortality rate has recently been reduced from 90% to 50%). If the patient indeed had *Mucor*, he would have to move quickly to save her life.

The patient was an adult-onset diabetic who controlled the disease through diet. There was also no evidence suggesting that she was immuno-compromised. Dr. S ordered an MRI because of his concern about a venous thrombosis, but when he found evidence of an infection in the orbit, which again suggested *Mucor*, he ordered a biopsy

to be done by an otolaryngologist. The results confirmed *Mucor*, which had begun to spread through the bone into the other orbit.

Dr. S had first heard about *Mucor mycosis* during his residency, since the chair of his department had specialized in orbit disease and had treated such patients. Dr. S had never treated the disease before, and, as soon as the diagnosis was confirmed, he asked a colleague who specialized in orbital disease to take on the patient. The colleague demurred, saying there was nothing he could do for the patient that Dr. S wasn't already doing.

Learning activities. Because the problem was emergent and the patient needed good information quickly, Dr. S sought immediate consultations, notably with the chair of the department where he did his residency.

That residency chair told Dr. S that it was possible to save the eye by debridement and irrigation with amphotericin B and IV medication, but doubted that aggressive treatment would save vision in the eye. Dr. S continued to consult with the expert throughout the course of treatment and follow-up.

He also did a Medline literature search, reading articles with abstracts that promised insights into the disease and its treatment. The most recent article, a case study, used the same procedure that the department chair had described. Finally, since this was not a diagnosis with which he was familiar, he consulted the five-volume ophthalmology series considered the textbook. He didn't have time to locate meetings and courses, and besides, there was no guarantee that he'd find topics of interest to this case.

Table A2

Summary of A Life-Threatening Infection				
	Stage 0: Scanning for Potential Problems	Stage 1: Deciding Whether to Take on the Problem	Stage 2: Learning the Required Skills and Knowledge	Stage 3: Gaining Experience
Goal	To find problems requiring an ophthalmologist's attention.	To decide whether to pursue this problem.	To learn what was needed to save the patient's life.	To understand what had happened.
Discrepancy	Dr. S is on call, waiting for potential problems.	Dr. S had to evaluate whether the problem was ophthalmologic and, if so, how serious it was.	Dr. S lacked information on <i>Mucor</i> and its treatment.	Dr. S required the perspective that comes with time to understand all that had happened.
Resources	ER personnel who first examined the patient and the patient herself.	Dr. S reviewed the patient's history, conducted a physical examination, and ordered tests.	Dr. S reviewed the literature (both general textbooks and specific articles) and consulted expert colleagues.	No new resources were used; Dr. S simply reviewed what had happened in light of what he'd learned.
Reflection	Dr. S considered the possibility that this was a problem for an ophthalmologist.	Dr. S considered the potential seriousness of the problem and whether he was the proper physician to be involved.	The emergent nature of the problem, and lack of information on the new therapy, and the need to convince colleagues made decision making emotional.	Dr. S leisurely reflected on what happened among the health care team as well as what happened to the patient.
Criteria for completion	Dr. S identified a potential ophthalmologic problem.	Dr. S determined that this was an ophthalmologic problem, that a solution might exist, that resources were available, and that whatever changes would occur to his practice were acceptable.	Dr. S arrived at a plan and was able to convince other members of the team to pursue that treatment plan.	Dr. S moved on to caring for other patients.

The other physicians with whom Dr. S was collaborating (an infectious disease specialist and the ear, nose, and throat specialists who did the biopsies and placed the irrigation tubes), each of whom had previously seen one such case, wanted to excise the orbit. And so, on top of managing the patient's treatment, he needed to convince his colleagues that the procedure championed by his former department chair was the way to go. He felt that his colleagues finally went along because none of them had the stature to argue against his former department chair.

What he learned. Dr. S noted that this was "not a planned learning experience."

The treatment was completely new to him and so qualified as a surprise. He was also pleased at the outcome: the patient's vision was lost, the orbit was salvaged, and she remained alive.

What happened when he applied what he learned? The patient lost vision in the first eye but not the second. And, of course, she lived and appeared to be doing well on follow-up. Interestingly, even though the patient lived and only lost vision in one eye, on discharge some members of the health care team still felt removal of the eye was appropriate.

On reflection. Dr. S views consultants the same way now as before the episode. Al-

though he feels uncomfortable imposing his perspective on others, he thought that doing so in this case was "the right thing to do." Based on this experience, if he finds himself in a similar situation in the future, he will be more confident advocating his point of view. His views of journals and other literature sources also remain the same. Indeed, he would both call someone if the problem were out of his area and do the same kinds of reading. Aside from the experience of dealing with *Mucor*, the biggest change that occurred was Dr. S's knowledge that he can prevail by force of argument even though his preference is to gain consensus. This was an unanticipated change to Dr. S's practice.