

**Original Article**

## **Study of the Factors Influencing the Stimulus to Learning Recorded by Physicians Keeping a Learning Portfolio**

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**Abstract:** *While studies in continuing education have identified the information sources most frequently used by physicians for learning, little is known of what stimulates physicians to engage in learning activities that lead to a commitment to adopt a new practice. This study reports on the recorded stimulus for learning of 8576 items of learning submitted by 652 physicians who voluntarily enrolled in the Maintenance of Competence program (MOCOMP®) of the Royal College of Physicians and Surgeons of Canada and used a paper or electronic diary (PCDiary®) to record self-directed learning activities. The most frequent stimuli for initiating learning were reading the medical literature and managing patients. The only demographic variable that significantly influenced the item stimulus profile of these physicians was the number of years since graduation ( $p = .0001$ ). Physicians less than 10 years from graduation more frequently recorded learning items stimulated by an audit of practice and less frequently by a discussion with peers compared with physicians in practice more than 10 years. Physicians in practice for more than 30 years initiated learning activities primarily based on their interaction with patients. There was no significant relationship between the item stimulus profile and the physicians' specialty type ( $p = .47$ ), size of the community where their practice is located ( $p = .24$ ), or their type of university association ( $p = .17$ ). This study provides evidence related to differences between the activities physicians perceived had stimulated learning and the likelihood that the learning would lead them to make a commitment to change practice. The stimulus code "reviewing the management of more than one patient" was 47% more likely (odds ratio = 1.47, 95% CI, 1.27, 1.71,  $p < .001$ ) and "audits of a clinical or laboratory practice" 31% more likely (odds ratio = 1.31, 95% CI, 1.04, 1.66,  $p = .024$ ) to result in a commitment to make a change in practice than reading the medical literature, the most frequently assigned stimulus for learning. The implications of these findings related to models of physician learning and studies of change in continuing medical education are discussed.*

**Key Words:** Continuing medical education, learning portfolios, outcome, planned change, stimulus for learning

A strong desire to maintain competence and provide exemplary care for their patients motivates physicians to continuously review and update their practices.<sup>1</sup> While studies<sup>1,2</sup> have identified the information sources most frequently used by physicians for learning, little is known of what stimulates a physician to engage in learning activities that lead to a commitment to adopt a new practice. In Schön's model of reflective practice, experts, in response to "reflecting-in-action," use information to solve problems without necessarily engaging in in-depth learning.<sup>3</sup> For instance, a physician may prescribe a new drug on the advice of a colleague without necessarily understanding its mechanisms of action. Schön used the term "reflection-on-action" to describe the process whereby experts answer questions they generate after reflecting on a recent experience. He contends that "reflection-on-action" stimulates critical thinking and in-depth learning that expands expertise. Health professionals, to promote reflection in practice, have increasingly used learning portfolios originally developed for students of the graphic arts.<sup>4</sup>

The Maintenance of Competence program (MOCOMP®) of The Royal College of Physicians and Surgeons of Canada introduced a paper diary in 1995 and a computerized diary, PCDiary®, in 1996 for physicians to record their self-directed learning.<sup>5,6</sup> Physicians using either the paper or PCDiary® are requested to record each item of learning in the form of a question or statement of a problem, assign a principal stimulus to the item (i.e., what triggered the question), list the resources used to answer the question, and record the intended outcome of learning in terms of a commitment to either make a change, seek more information before deciding whether there was a need to change, or not change their current approach to practice. Completed items of learning are transferred to a searchable database on the Internet. PCDiary® has search and sort capabilities that enable the user to review items of learning by topic, stimulus, and outcome; print reports; and interact with digital libraries. Collectively, these

features reflect the software's ability to function as a learning portfolio.

In this publication, we report on the recorded stimuli for 8576 items of learning submitted by 652 physicians (422 used the paper diary and 230 used PCDiary®) between January 1, 1995 and February 14, 1997. The stimulus codes in the paper diary and PCDiary® are identical. In performing this analysis of what stimulated learning in practice independent of the type of diary used, we were interested in the following questions:

1. What is the frequency distribution of individual stimuli that initiated learning activities among specialists using the diaries?
2. Do demographic variables, including specialty type, community size, faculty appointment, and years in practice, significantly influence the stimulus codes assigned by specialists to items of learning?
3. Are there differences between the stimuli for learning and the likelihood that physicians would make a commitment to make a change in practice?

## **Methods**

From January 1, 1995 to February 14, 1997, 707 specialists submitted 10,168 items of learning to the central database. Two of the authors (CC and JP) individually reviewed all items of learning and excluded those items of learning that were restricted to one or two words and did not describe a question or problem (e.g., "laparoscopic cholecystectomy"); items that reflected attendance at a group CME activity (e.g., "attended a CME symposium on diabetes"); or items that described the physician's participation in educational activities (e.g., "listened to an audiotape on asthma"). An inter-rater reliability study was completed using a random sample of 400 items initially classified

## *Learning Portfolio*

SEARCH RESULTS		
<div> <div>STATS</div> <div>MENU</div> <div>MEDLINE</div> <div>MORE</div> </div>		
#	Question	Date Posted
31	How do you distinguish between pathological causes of ST elevation and early repolarization on ECG	28-JUN-97
32	Is Valproate helpful in migraine prophylaxis	28-JUN-97
33	What factors are helpful in preventing graft occlusion following coronary artery bypass surgery	28-JUN-97
34	What is the cardiac troponin level and how is it useful in diagnosing acute myocardial infarction	28-JUN-97
35	What are leukotriene inhibitors and how are they used	28-JUN-97
36	What is fexofenadine and how is it used	28-JUN-97
37	What are potential causes of poor R wave progression on ECG	28-JUN-97
38	Is atenolol helpful or harmful in perioperative care of cardiac patients with noncardiac surgery	28-JUN-97
39	Should sublingual nifedipine be used in hypertensive emergencies	28-JUN-97
40	In patients with lone atrial fibrillation, is warfarin with aspirin superior to warfarin adjusted to maintain INR of 2.0 - 3.0	28-JUN-97

Figure 1 Sample items of learning from MOCOMP's question library.

to be included or excluded based on the above criteria. The inter-rater agreement was 91% (95% confidence intervals [CIs] 85–96%). The total rate of disagreement between the raters was 2.5% (10 items) of learning. Thirty-eight physicians (paper diary users) had all of their learning items excluded based on one or more of the above criteria. Seventeen other paper diary users (and their submitted items of learning) were excluded because of incomplete demographic data. The physician's demographic data include specialty certification, community size where their practice is located, university faculty appointment, and number of years since graduation. Overall, 1592 items of learning were excluded from further analysis.

The remaining 8576 items of self-directed learning submitted by 652 physicians formed the

basis for this study. Examples of items of learning in the central database are shown in Figure 1. The frequency distribution of the duration of time physicians recorded that they had spent on each item of learning was expressed in four categories: less than 1 hour, 1787 (21.6%) items; 1 to 2 hours, 4459 (54.0%) items; more than 2 to 10 hours, 1648 (20.0%) items; and more than 10 hours, 359 (4.3%) items (data missing from 323 items of learning).

Demographic information on the 652 physicians, specialists certified by The Royal College of Physicians and Surgeons of Canada, are summarized in Table 1. Physicians recording a learning item in either the paper diary or PCDiary® were requested to select from a menu of 10 stimulus codes, shown in Table 2, one principal stim-

**Table 1 Demographic Information for 652 Physicians**

Groupings	Physicians	
	Number	%
<i>Specialty Groups</i>		
Psychiatry	131	20.1
Surgery	178	27.3
Internal medicine or pediatrics	106	16.3
Medical subspecialties	66	10.1
Radiology and radiotherapy	57	8.7
Laboratory and community medicine	36	5.5
Intensive care	78	12.0
<i>Community Size</i>		
Under 50,000	89	13.7
50,001–100,000	118	18.1
100,001–500,000	188	28.9
Over 500,000	256	39.3
	Missing 1	
<i>Faculty Appointment</i>		
Full time	106	16.3
Part time	86	13.2
Clinical	119	18.3
Other	18	2.7
No appointment	323	49.5
<i>Years Since Graduation</i>		
From 1985–1997 ( $\leq 10$ yr)	83	12.8
1975–1984 (11–20 yr)	241	37.1
1965–1974 (21–30 yr)	198	30.5
1930–1964 ( $>30$ yr)	127	19.6
	Missing 3	

\*Number of items of learning recorded by physicians.

†Percentage of total number of items submitted by 652 physicians.

ulus or trigger that initiated the learning activity. They were also requested to select one of the three outcome codes for each item of learning they entered. The three outcome codes were “planning to change my practice,” “seek more information before deciding to make a change,” and “not planning to change my practice.”

**Table 2 Stimulus Codes Included in the MOCOMP® PCDiary® and Paper Diary**

Number	Stimulus Code
1	After reviewing the management of more than one patient
2	Audit of clinical or laboratory practice
3	Discussion with peers
4	During the management of a current patient or problem
5	Group CME activity
6	Reading (scanning) of literature
7	Research
8	Self-assessment program, quizzes
9	Teaching
10	Others

### Data Analysis

The distribution of stimulus codes assigned by physicians to individual items of learning was derived and expressed in percentage. The 10 percentages derived from the 10 stimulus codes represented the “item stimulus profile” for each participant. A summary of the item stimulus profiles across all participants was then derived, expressed by a mean with 95% CIs, and linked to the four demographic variables of each participant shown in Table 1. A multivariate analysis of variance was used to determine if any demographic variables significantly influenced the mean item stimulus profile of the physicians included in this study.

The assigned outcome code “planning to change my practice” was related to the following participant’s characteristics—specialty type, community size, faculty appointment, years in practice, and the stimulus for learning—in a generalized mixed effect logistic regression model that took into account the correlation in item outcomes pertaining to a single participant.<sup>7</sup> Given the fitted model, we calculated the odds ratios and their 95% CIs for the “planning to change my practice” outcome corresponding to each stimulus while

**Table 3 Frequency Distribution of Stimuli for Learning**

Stimulus Code	Physicians	
	Items	%
After reviewing the management of more than one patient	1434	16.8
Audit of clinical or laboratory practice	370	4.3
Discussion with peers	555	6.5
During the management of a current patient or problem	1778	20.8
Group CME activity	528	6.2
Reading (scanning) of literature	2458	28.8
Research	286	3.4
Self-assessment program, quizzes	335	3.9
Teaching	422	4.9
Others	368	4.3
	Missing 42	
Total	8534	100.0

treating reading or scanning the literature as a reference level.

## Results

The frequency distribution of the 10 stimulus codes assigned by specialists for all learning items included in this study is shown in Table 3. The stimulus for learning most frequently recorded by specialists was reading the literature, followed by “during the management of a current patient or problem” and “reviewing the management of more than one patient.” There was no significant relationship between the mean item stimulus profile and the participants’ specialty ( $p = .47$ ), community size ( $p = .24$ ), or faculty association ( $p = .17$ ). However, there was a statistically significant association between the mean item stimulus profile and the years since graduation ( $p = .0001$ ). The relationship between item stimulus profiles and years since graduation is summarized in Table 4. Physi-

cians less than 10 years from graduation more frequently recorded learning items stimulated by an audit of practice and less frequently by a discussion with peers as compared to physicians in practice more than 10 years since graduation. In contrast, physicians more than 30 years from graduation more frequently recorded learning items initiated after reviewing the management of more than one patient and those stimulated by the management of a current patient or problem. Physicians more than 20 years from graduation more frequently recorded items of learning initiated by regular reading or scanning of the medical literature and attending group CME activities compared with colleagues less than 20 years from graduation.

We checked for the potential association between the stimulus for learning and the four demographic variables with the assigned outcome code “planning to change my practice.” Only the stimulus for learning exerted an effect on the consideration to change ( $p < .001$ , logistic regression). Table 5 describes the odds ratio for each stimulus for learning and the assigned outcome code “planning to change my practice.” Learning items initiated after reviewing the management of more than one patient and by an audit of clinical or laboratory practice were 47% (95% CI 27, 71%  $p < .001$ ) and 31% (95% CI 4, 66%  $p = .024$ ), respectively, more likely to result in a commitment to change practice than reading the medical literature. In contrast, items of learning initiated by teaching and research were 36% (95% CI 50, 29%  $p < .001$ ) and 29% (95% CI 46, 7%  $p < .014$ ), respectively, less likely to result in a commitment to change practice than reading the medical literature.

## Discussion

In this study, we sought to clarify the influence of four demographic variables on the stimulus profiles of physicians who voluntarily enrolled in the MOCOMP® program and used the paper diary or PCDiary® to keep a record of their self-directed learning activities. In addition, the study provides

**Table 4 Summary of the Item Stimulus Profiles (%) by Years Since Graduation**

Stimulus Code	Years of Graduation											
	≤10			11–20			21–30			>30		
	95% CI			95% CI			95% CI			95% CI		
	Range			Range			Range			Range		
	Mean	Lower	Upper	Mean	Lower	Upper	Mean	Lower	Upper	Mean	Lower	Upper
After reviewing the management of more than one patient	7.0	4.8	9.2	8.5	7.0	9.9	8.7	7.1	10.3	14.7	12.8	16.6
Audit of clinical or laboratory practice	16.4	14.6	18.2	10.0	8.8	11.2	7.5	6.2	8.8	5.4	3.9	7.0
Discussion with peers	5.8	4.0	7.7	9.9	8.8	11.1	6.8	5.4	8.1	8.5	6.9	10.1
During the management of a current patient or problem	11.1	8.5	13.6	10.2	8.5	11.8	10.6	8.8	12.5	14.8	12.6	17.0
Group CME activity	8.1	6.0	10.2	7.9	6.5	9.2	12.5	11.1	14.0	13.9	12.1	15.6
Reading (scanning) literature	11.9	8.1	15.7	13.0	10.6	15.5	17.9	15.2	20.6	16.1	12.9	19.3
Research	6.6	4.9	8.3	10.7	9.6	11.8	6.6	5.4	7.8	7.0	5.5	12.6
Self-assessment program	10.7	8.8	12.6	9.1	7.9	10.3	11.2	9.9	12.6	6.9	5.3	8.5
Teaching	6.9	4.9	8.8	5.4	4.1	6.6	10.5	9.1	11.9	4.1	2.4	5.7

an answer to the question are some activities that the physicians perceive stimulate their learning more likely to lead them to commit to changing their practices than other activities?

Learning activities recorded by our study physicians were most frequently stimulated by reading the medical literature and managing patients and least frequently by audits of practice, participating in research, or completing self-assessment programs. In spite of the stereotypical image we have regarding differences between behavioral characteristics of physicians in different specialties, there appear to be no significant differences across specialties in the activities that stimulate

physicians to embark on learning activities. Equally, neither the size of the community in which physicians practice nor their affiliation with a university influenced the mean item stimulus profile of these physicians. In spite of the opportunities to attend educational seminars and participate in teaching and research, the activities that stimulate university-based physicians to engage in learning did not differ significantly from the activities that stimulate learning among their colleagues in community practice.

Surprisingly, the number of years since graduation was the only demographic variable that significantly influenced the mean item stimulus

**Table 5 Odds Ratio (95% CIs) of the Outcome Code  
“Planning to Change My Practice” for Each Stimulus Code**

Stimulus Code	Factor			p Value*
	Odds Ratio	95% Lower Bound	95% Upper Bound	
After reviewing the management of more than one patient	1.47	1.27	1.71	< .001
Audit of clinical or laboratory practice	1.31	1.04	1.66	.024
Discussion with peers	1.03	0.85	1.26	.762
During the management of a current patient or problem	1.08	0.94	1.25	.265
Group CME activity	1.10	0.90	1.35	.365
Reading (scanning) literature	1.00			
Research	0.71	0.54	0.93	.014
Self-assessment program	0.92	0.71	1.20	.531
Teaching	0.64	0.50	0.81	<.001
Others	1.04	0.82	1.34	.728

\*p value is from t-statistics testing for the null hypothesis that the odds ratio of the outcome “planning to change my practice” of a particular stimuli as compared to “reading (scanning) of literature” is equal to 1 (i.e., no difference).

profile of physicians in this study. Physicians less than 10 years from graduation more frequently used objective means (audits of practice) as a stimulus to initiating learning activities compared with their colleagues who had been in practice more than 30 years. Physicians in practice for more than 30 years initiated learning activities based primarily on their interaction with patients. Physicians in practice more than 20 years recorded learning items that were stimulated by attending group CME activities significantly more often than their younger colleagues.

The importance of the differences observed between the item stimulus profiles of physicians becomes more evident when we examine the relationship between individual stimuli for learning and the likelihood of the physician making a commitment to change his or her practice. Our study was not designed to confirm that physicians who commit to changes in practice actually implement these changes. The rationale behind encouraging diary users to decide on an outcome to their learning is based on observations that physicians, like

other adult learners, create images of how learning might be applied.<sup>8</sup> Indeed, studies show that physicians who commit to changing their practice as a consequence of engaging in learning activities have a higher rate of success in making changes than physicians who do not make a commitment to change.<sup>9</sup>

We contend that physicians who strive to enhance the efficiency of learning in practice are interested in knowing whether certain activities stimulate learning that leads to a commitment to change practice more often than other activities. The results from this study support Schön’s hypothesis that learning stimulated by “reflection-on-action” is more likely to lead to a change in practice than learning stimulated by “reflection-in-action.”<sup>3</sup> We contend that the stimuli for learning, “reviewing the management of more than one patient” and “audits of a clinical or laboratory practice,” operate at the stage of “reflection-on-action” in Schön’s model of learning in practice. In this study, the stimulus code “reviewing the management of more than one patient” was 47%

more likely to lead to a commitment to change practice than regular reading of the medical literature, the most frequently assigned stimulus for learning. Similarly, the stimulus “audits of a clinical or laboratory practice” was 31% more likely to result in a commitment to make a change in practice than reading the medical literature. In contrast, learning stimulated “during the management of a current patient or problem,” which we contend relates to Schön’s “reflecting-in-action,” was no more likely to result in a commitment to change practice than reading the medical literature.

Items of learning stimulated by attending group CME activities and completing self-assessment programs had the same likelihood of leading physicians to a commitment to changing practice as learning stimulated by reading the medical literature. Physicians, as part of a continuing education strategy to maintain their expertise over time, commonly use these educational activities; however, they were less likely than other educational options to promote a commitment to change. Items of learning stimulated by teaching and research activities were significantly less likely than reviewing the management of patients (informally or through an audit of practice) to lead physicians to commit to changing their practice. Reading the medical literature is an important and essential activity for physicians who seek to maintain their expertise over time. However, physicians need to include as part of their continuing professional development other activities that enhance the likelihood that learning will result in a commitment to change practice.

Physicians estimated that they spent 2 hours or less learning in 75.6% of the questions submitted to the database. We believe that items of learning of this duration suggest that physicians were responding to an immediate need in their practice, which may correspond to Schön’s “reflection-in-action.”

The limitations of this article relate to the generalizability of the finding based on the bias of reporting on items of learning from physicians who voluntarily enrolled in the MOCOMP® pro-

gram and used a paper or PCDiary® as an aid to learning in practice. In addition, we excluded from further analysis items from 55 (7.8%) physicians because of incomplete demographic information or because their diary entries did not meet predefined criteria. In spite of these limitations, our findings provide evidence in support of models of physician learning that emphasize the importance of practice reflection and contribute to our understanding of what variables increase the likelihood that engaging in learning will result in a commitment to change practice. Learning portfolios appear to promote the process of change by prompting physicians to reflect on the outcome of engaging in a learning activity. We shall repeat our analysis on new data submitted by the same physicians during 1997–1998 in an attempt to ensure that our observations are stable over time. Also, further studies are in place to determine whether the type of diary (paper or PCDiary®) influences the activities that stimulate physicians to engage in learning in practice.

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## *Learning Portfolio*

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