Documenting the Impact of Formal Instruction on Clinician Change

Dale Moore, DVM, PhD, H.B. Slotnick, PhD

1School of Veterinary Medicine, University of California, Davis, California; 2School of Medicine, University of North Dakota, Grand Forks, North Dakota

ABSTRACT

Background: Continuing healthcare education providers are asked to evaluate the impacts their programs have on changing clinician behavior and patient outcomes. Although impacts on learning and skills acquisition are relatively easily measured, impacts on behavior change and healthcare are often difficult to accomplish and document within traditional continuing education programs because learners are at different stages in the process of learning. This suggests that determining each learner’s stage of learning before and after an educational program should allow documentation of individual and group change.

Method: A staged learning theory was used to document the impacts of 3 educational interventions by using responses to clinical scenarios before and immediately after the program. Response options used in pre- and post-tests for the scenarios assessed the four stages of learning: scanning, evaluation, learning, and gaining experience. Response data were trinomial in nature for learners likely to be in the situations described in the situations scenarios. Triangular graphs were used to represent the pre- and post-program group response data.

Results: In the AMEE study (n = 35; duration, 1.5 hour), little stage change was noted for scenarios not covered by instruction, while about half the learners showed stage progression for scenarios covered. In the Chicago study (n = 100; duration, 1.5 days), for 4 problems addressed by the course, about half began at the evaluation stage and moved toward gaining experience by the end of the workshop. In the Dairy veterinarian study (n = 23; duration, 3 days), most participants were at the learning stage and moved through the gaining experience and back to evaluation (ie, they felt comfortable handling the kinds of problems covered by instruction).

Conclusion: Practical application of learning stage theory can be used to document educational program participant change. After short-duration programs, small group changes in learning stage can be made. With larger, intensive programs, larger group changes are possible, including moving groups of learners from evaluation through learning to gaining experience.


INTRODUCTION

A requirement of the Accreditation Council for Continuing Medical Education (ACCME) and an important part of quality assurance in continuing medical education (CME) and continuing professional development (CPD) programs is evaluating each program’s impacts on those in attendance [1]. Measuring such impacts on knowledge and skills is relatively straight-forward, but documenting change in clinical behavior is more difficult [2-6]. While change occurs quickly when the problem motivating learning is specific to a given patient, broader behavior change (eg, adopting new approaches to some general problem) occurs more slowly [7,8] and then in response to multiple educational interventions [9]—whether self-directed or formal in nature.

There are several explanations for why general changes require multiple interventions and seldom follow participation in any given continuing education activity. First, the earlier activities in behavior change (following Prochaska’s [10-12] and Mezirow’s [13] work) addressed issues that must be resolved before change can be observed in later stages. Green’s PRECEDE model of change, for example, posits the existence of predisposing, enabling, and reinforcing factors as necessary for individual behavior change [14]. Under these circumstances, while CME/CPD providers may address many of the enabling and some of the reinforcing factors facilitating clinician change, the predisposing factors often remain internal to the individual. This means that if clinicians are not “predisposed” toward changing their behaviors, they won’t position themselves to be “enabled” or “reinforced” through CME.

A second explanation arises from the fact that Prochaska, Mezirow, and Greene have written about the “episodic nature of learning,” that learning occurs within an identifiable time span and proceeds through a series of identifiable stages. While other theorists have discussed the staged nature of learning [15-19], the conceptualization...
Measured impacts on knowledge and skills is relatively straightforward, but documenting change in clinical behavior is more difficult.

Slotnick’s theory is based on assumptions arising from classical adult learning theory (eg, Knowles [23]) including the following facts. (1) Adults are independent learners. In veterinary and human medicine, students become progressively more independent as they move from observing others’ practice to practicing under supervision to independent practice [24]; and as independent practitioners, they retain to themselves the responsibility for deciding when and how to learn. (2) Adulthood brings with it the accumulation of experience and insights into those experiences that embody what adults have learned. This repository provides the background against which further learning takes place and often involves not only the accretion of new experiences but occasionally a restructuring of the mental representation of these experiences and insights so that what is understood is more useful to the learner in addressing her needs. (3) Readiness to learn is related to the psychosocial developmental tasks faced by individual learners and contributes to why a given learning activity results in different learning outcomes for clinicians at different points in their careers. (4) Adults seek to learn solutions in anticipation of resolving problems they currently face, and they almost never learn solutions to problems they do not have. (5) Finally, adults are motivated internally; they seek to do things because they recognize them as important to themselves and/or others for whom they are responsible.

Under staged theories of learning, the problem of documenting learning outcomes from CPD/CME activities evolves from simply looking for clinical change to looking for learners’ movement from one stage to the next in their learning episodes, acknowledging that behavior change might finally be observed, but only late in the process. The purposes of this paper are to (1) show how the staged nature of learning facilitates evaluation of educational programs, and (2) derive implications from this approach both for understanding how CME/CPD activities contribute to implementation of clinical change and for further study of this approach. Thus we begin by dividing learning episodes into four stages [19]:

1. Scanning: The clinician is alert for potential problems that might require attention.
2. Evaluation: The clinician evaluates each potential problem to decide whether to take it on. Clinicians at this stage behave as if they address four questions: Is this problem appropriate to me? Is there likely a solution to the problem? Are there resources available for learning the solution? Will learning to solve the problem benefit my practice? They progress to the next stage when they answer each question “yes.”
3. Learning: The clinician gains the skills and knowledge anticipated to resolve the problem at hand.
4. Gaining experience: The stage begins with the clinician using what's been learned in clinical practice for the first time (ie, this is the first time clinical change is observable) and continues until she’s mastered the skills and knowledge required to solve the class of problems addressed. Clinicians often report feeling very aware of what is taking place and a noticeable degree of uncertainty about how things will work out as they begin the stage. At the stage’s end (when the clinical change is part of the practitioner’s repertoire and the clinician has used the new skills often enough to know how they “work,” and the kinds of problems that are addressable with the use of them), the uncertainty is replaced by confidence and using the skills and knowledge is a matter of second nature.

**MATERIALS AND METHODS**

**The Studies**

The 3 studies considered here look at outcomes of 3 different professional instructional activities from the perspective of learning as a staged activity. The courses were of different duration, covered different topics, and had different types and sizes of audiences.

- The Association for Medical Education in Europe (AMEE) study covered the use of the staged theory of episodes to document learners’ needs in a 2-hour lecture.
- Achieving Exemplary Performance on ACCME Essential 2 (Chicago Study) covered approaches to satisfying ACCME essentials on assessing needs and evaluation in a 1.5-day workshop.
- The Dairy Performance Series (Dairy study) covered veterinary medical informatics for dairy performance medicine in a 3-day workshop.

In the AMEE study, 35 medical educators were asked to respond before and after instruction to 7 problems presented as vignettes, 4 of which covered the session’s topic (the epidemiology of physician learning) and 3 that did not. The 100 participants in the Chicago study responded to 12 vignettes before and after 1.5 days of
Table 1. Examples of Clinical Vignettes from the AMEE Study*

<table>
<thead>
<tr>
<th>Preparing for Bioterrorism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructions. The nation’s minister of health must make certain the country is prepared for possible bioterrorism threats. You have been asked to participate in the task force the minister has formed to address this issue. The pages that follow describe a series of activities the task force might be asked to perform, and you are to indicate whether you feel you’re currently able to participate in the activities or whether you’ll first need additional learning. Please use the options (below) to indicate what it is that you might need to learn.</td>
</tr>
</tbody>
</table>

1. The taskforce chairwoman says she needs a list of all physicians who might be called upon in the event of a bioterrorism emergency. She asks you if you’ll locate such lists.
   - A. I wouldn’t be asked to handle this kind of problem.
   - B. I am comfortable handling this problem. I might be interested in information so I can decide when next to update my skills and knowledge in the area.
   - C. I need to learn/update my skills and knowledge in this area so I can handle the problem.
   - D. I have recently updated my skills and knowledge in this area. I might, however, be interested in hearing how others approach this problem.

2. All doctors already have some idea of what anthrax and smallpox are, but most have little or no experience with these diseases. You and two other group members are to put together a pencil-and-paper survey questionnaire that doctors can fill out to determine what they know about how to prevent, diagnose, and manage these diseases.
   - A. I wouldn’t be asked to handle this kind of problem.
   - B. I am comfortable handling this problem. I might be interested in information so I can decide when next to update my skills and knowledge in the area.
   - C. I need to learn/update my skills and knowledge in this area so I can handle the problem.
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3. All doctors already have some idea of what anthrax and smallpox are, but most have little or no experience with these diseases. You and two other group members are to put together a pencil-and-paper survey questionnaire that doctors can fill out to determine what they know about how to prevent, diagnose, and manage these diseases.
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   - B. I am comfortable handling this problem. I might be interested in information so I can decide when next to update my skills and knowledge in the area.
   - C. I need to learn/update my skills and knowledge in this area so I can handle the problem.
   - D. I have recently updated my skills and knowledge in this area. I might, however, be interested in hearing how others approach this problem.

*Note that options B, C, and D correspond to the evaluation, learning, and gaining experience stages of learning, and that the content in question 1 was not covered in the session while the content for question 3 was covered.

Table 2. Options Used in the Pre- and Post-Program Questionnaires Using the Learning Stage Theory in Program Evaluation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Option Presented to Learners Pre- and Post-instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Not applicable to me: I don’t expect to be in a situation like this one.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>I’m comfortable with my ability to handle the situation described; all I might be interested in is information so I can decide when next to update in the area.</td>
</tr>
<tr>
<td>Learning</td>
<td>I need to update my skills and knowledge in order to handle this situation.</td>
</tr>
<tr>
<td>Gaining Experience</td>
<td>I’ve recently updated myself on the skills and knowledge needed to handle the situation; all I might be interested in is hearing about the experiences others have had using those skills and knowledge.</td>
</tr>
</tbody>
</table>

Data Analysis

The studies were exploratory in nature and precluded hypothesis testing. The analysis followed John Tukey’s lead [27] by using graphical methods to explore the data. After censoring for respondents who did not expect to deal with problems described in the vignettes, the response data were of a trinomial nature. Each of the 3 options was mutually exclusive (a person could not be at 2 stages simultaneously) and collectively exhaustive (a person could be at no other stages). The trinomial data allowed the use of triangular graphs to summarize the educational status of the group pre- and post-program (Figure 1) [28] with each vertex of the triangle representing a stage in the learning episode. The top vertex represents evaluation, the lower left learning, and the lower right gaining experience.

**Figure 1.** A triangular graph representing pre- and post-program location of a group of respondents. Because the pre-program point is closest to the evaluation corner of the triangle, more people in the group selected “evaluation” on that occasion. The post-program point shows that most of the people in the group were at the learning stage.
In triangular graphs, the percentage of people at each of the 3 stages of learning in the group is represented by a single point; the closer that point is to a vertex, the more people in the group were at the stage represented by that corner. The perpendicular distance from the point to each of the 3 vertices sum to 100% so that each group's point uniquely reflects the percentage of people in that group at all stages. The distance between a group's pre- and post-instruction points reflects the change in percentage of people at each stage. A vector (an arrow) was constructed to connect the group's pre-test point to its post-test point, the direction and the length of which identifies the nature and magnitude of change due to instruction.

RESULTS

Cross-tabulations for the AMEE study questions 1 and 3 (Table 2) provide examples of how learning changed due to instruction (Table 3). For the AMEE study more generally, most participants came to the lecture in the learning stage for the 3 problems not covered by instruction and were changed little through their attendance, with what little movement occurred being toward the evaluation stage of learning (Figure 2A). For the 4 problems addressed by the course (Figure 2B), however, about half those attending were in the evaluation stage beforehand and most moved toward the learning stage by the end.

For problems presented pre-instruction in all 12 vignettes in the Chicago study, most learners were at the learning stage. Instruction resulted in large group changes (long arrows from pre- to post-instruction points in the triangular graphs) toward the gaining experience stage (Figure 3).

Pre-test results for the dairy herd informatics study demonstrated that for half the vignettes, most of the participants were in the evaluation stage and moved through learning toward gaining experience—that is, arrows start at the mid to upper left and move down and to the right (Figure 4). For those vignettes where most participants entered at the learning stage, they moved through gaining experience and back to evaluation (arrows moving up and to the right). Note that one set of responses are for a vignette not covered by the course with a vector that moved from learning to evaluation—a pattern shared by 3 other problems.

DISCUSSION

These studies provide empirical data showing the application of staged learning theory in documenting impacts of CME/CPD on learning. The brief AMEE course occurred at the organization’s annual meeting as one of a number of sessions offered, and it was unlikely that anyone in the audience came to the conference solely to learn about the topic. Furthermore, the topic was new enough that most attendees could be assumed to be at the evaluation stage (ie, they were there to decide whether they wanted to learn more about epidemiology as applied to physician learning). Because the literature on the impacts of instruction suggests that such short interventions are unlikely to produce changed behavior [2-4,9], we anticipated seeing only random movement for the 3 vignettes on issues not covered by instruction and movement from the evaluation to learning stages for the 4 vignettes that were addressed. If the presentation convinced participants that the epidemiology of physician learning was of interest, they would want to learn more about it and were likely not ready to use it, which was what was observed.

AMEE learners contrasted with those in the Chicago study because the Chicago attendees were there specifically to learn more about how to satisfy certain ACCME certification criteria. We expected to see the vectors indicating pre- to post-instructional change points from the lower left-hand part of the triangular plot with arrows heading either downward (ie, more movement toward the learning stage) or toward the lower right-hand corner (ie, toward the gaining experience stage). Most of the vectors traversed the graph from learning to gaining experience and were of a larger magnitude than the ones in the AMEE study, likely because of the duration of instruction.

The Dairy veterinary informatics course was 3 days in duration and resulted in large changes in the group—from learning through gaining experience and back to evaluation for a number of practice vignettes. The implication for a long-duration, intensive program is that individuals can come to a program trying to decide if the program’s topic is one for which they need new information, and if they

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Question 3</th>
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<tbody>
<tr>
<td><strong>Evaluation</strong></td>
<td><strong>Learning</strong></td>
</tr>
<tr>
<td>Evaluation</td>
<td>5</td>
</tr>
<tr>
<td>Learning</td>
<td>5</td>
</tr>
<tr>
<td>Gaining Experience</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
</tr>
</tbody>
</table>

*After censoring for respondents who do not expect to be asked to handle such problems.*
decide to learn, they do learn and move to the stage of gaining experience. For the vignettes that had trajectories similar to the one not covered by instruction, it is likely that the topics were either not covered well in the program or were not compelling enough for participants to engage in learning.

A caveat to interpretation of the results is that all of the data were based on self-report. This can be a problem because self-reports of learning needs may not correlate well with subject matter test scores [29]—though there is also evidence that post-test self-reports correlate with actual behavior change [30]. Attenuating the possible weakness of self-report is the fact that there is no “best” or “most flattering” option associated with each vignette; respondents do not put themselves in a more sophisticated light, for example, by picking one option rather than another. Future research should examine the relationship between what learners report and what they do in clinical practice. Such findings would firm up the relationship between reports of educational status and behavior changes made after a course.

The triangular graph method is visually appealing and easy to create, and it allows for simultaneous comparisons of responses to multiple questions. Disadvantages are that statistical methods attuned to problems involving trinomial data are not well-developed [31], and the methods used here do not focus on individual changes but rather on summarized group findings.

In conclusion, stage-to-stage movement due to individual instructional interventions can be documented by relying on the concept of learning episodes. Furthermore, this concept is consistent with the principles of adult learning and, in conjunction with them, makes claims explaining why clinicians don’t learn things that—to dispassionate third parties—seem quite reasonable. What is compelling to one person isn’t necessarily compelling to others and may fail to address the “is this a problem for me now?” question.

Because learning episodes take time (often months and even years), it is unreasonable to expect that a single intervention will change behavior except where the learner shows up both at the learning stage and with some immediate need that is addressed by instruction. It is more reasonable to look for behavioral change after learners have had multiple exposures to instruction, given the opportunity to go through all the stages.

Because the learning issues addressed vary from stage to stage (eg, instruction at the evaluation stage is concerned with the problem precipitating learning rather than the skills and knowledge needed to solve the problem while the learning stage issues consider those skills and knowledge specifically), multiple interventions are appropriate both because learning needs vary from stage to stage and because teaching the things needed at one stage are unlikely to address the needs of other stages.

Seeking evidence of changed clinical behavior early in a learning episode is premature because much of what happens during evaluation is often not observable. A clinician may be reading, thinking, and discussing, all with the pur-
pose of deciding whether to learn something new, the result of which might be the decision not to continue further for reasons that are defensible.

The advantages of the learning stage evaluation technique presented here include the following. (1) It incorporates practice problems as the basis for evaluating learning stages; (2) it evaluates changes that are dependent on what stage the learners begin the educational program; and (3) it can document the group changes based on these stages. The triangular chart offers a parsimonious graphical representation of pre- and post-program responses to numerous practice problems simultaneously. From practical applications of the technique, the data imply that with short-term interventions, only small changes in the educational status of groups with respect to specific problems can be made. With larger, intensive programs, larger group changes are possible, including moving groups of learners from evaluation through learning to gaining experience.

REFERENCES