Evaluation of “Point-in-Time” Follow-up Assessment on the Retention of Knowledge from a Traditional CME Activity

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ABSTRACT

Background: The model of traditional continuing medical education (CME) courses that rely primarily on a lecture format is felt to be a relatively ineffective teaching method. This pilot study explores the use of serial point-in-time testing as a strategy for improving the CME learning process.

Method: Attendees at an annual 4-day traditional CME course voluntarily agreed to complete a pre-test as well as post-tests at varying times following the activity.

Results: Twenty-seven learners agreed to participate in a longitudinal point-in-time assessment of their knowledge in areas covered in the 4-day CME program. On serial testing over time with a 10-question instrument, a significant average gain of 2.55 points was seen between testing conducted before and immediately after the activity. One month following the program, the average subject demonstrated significant gains of 5.36 points compared to pre-test scores and 1.93 points from immediate post-test scores. Six months following the program, the average subject maintained a significant gain of 3.29 points from pre-test scores but lost the incremental gain from one-month scores.

Conclusion: This pilot study suggests that the strategy of administering point-in-time tests prior to and serially following a traditional CME activity may improve its educational effectiveness.

INTRODUCTION

Continuing medical education (CME) has traditionally focused on the development and maintenance of professional knowledge and skills, operating under the premise that assumes “if they know, they will change” [1]. The roots of CME date back to 1947 when the American Academy of General Practice included in its bylaws a membership requirement of a “minimum of one hundred and fifty hours during this three-year period in postgraduate training of a nature acceptable to the Membership Committee” [2]. Following the publication of a study of postgraduate medical education in the United States by the AMA Council on Medical Education in 1955, the AMA House of Delegates in 1959 urged replacement of the term “postgraduate medical education” with “continuing medical education.” Ten years later, the AMA laid the foundation of the current system of CME with creation of its Physician’s Recognition Award [3].

Thus, for more than half a century, physicians have looked to CME as a means for staying current after completion of their graduate medical education curriculum. In striving to meet this need, CME providers have largely drawn from the medical school model and relied heavily on the traditional classroom-style didactic lecture as their primary mode of instruction. Analyses of this teaching vehicle, however, have underscored its lack of effectiveness, particularly in the absence of audience interaction or some other form of adjunctive educational intervention [4,5].

The failure of the medical school model in the CME venue is not surprising in light of the disparity between the two settings. Unlike medical school, where learners have ample opportunity for interaction and longitudinal reinforcement of the learned material, learners in the CME arena disassemble and go their separate ways immediately following the activity. Whereas medical students are required to demonstrate their mastery of the instructional material at a later time in order to earn “credit” (i.e., “pass” the course), CME learners receive immediate gratification and not infrequently are awarded CME credit simply by “showing up.”

A potential contributing factor for the inability of traditional CME to appreciably impact physician behavior is the failure to
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MATERIALS AND METHODS
The study participants were enrollees in a traditional CME course on office-based gynecology for primary care. The program consisted of 20.5 credits of didactic instruction and 5 credits of practical skills workshops. The curriculum was organized along 4 subject areas: common gynecological problems, gynecologic endocrinology, family planning, and menopause. Faculty members included 6 board-certified family physicians and 2 board-certified gynecologists, all of whom were faculty members at university medical schools. The learning objectives of the program are listed in the Table. The content of each presentation was independent of the others.

Using a 5-point Likert scale, all program registrants were asked to complete an evaluation form asking them to rate how well the program achieved its educational objectives, taught new information and/or verified important information, and provided information likely to have an impact on their individual practices.

As part of a more in-depth program evaluation, 27 attendees were recruited prior to the start of the educational activity to participate in an evaluation of learning retention. Each volunteer agreed to complete a pre-test, a post-test that had to be completed and returned immediately upon completion of the program, and additional post-tests mailed to them 1 month and 6 months following the program. Each test consisted of 10 items. Test questions were based on faculty presentations and covered areas deemed by the presenter to be an important “take-home” point of their presentation.

The incentive for completing the study was a medical textbook of the volunteer’s choice with a dollar value of $150 or less.

The post-tests were graded, and participants were mailed feedback on their performance, which consisted of their test scores and the correct answers. The score for each test was calculated as the number of correct answers. Each subject’s changes in knowledge over time were assessed as score differences. Knowledge changes between 2 time points were tested for statistical significance using the signed rank test, based on a null hypothesis of no change in knowledge (a score difference of zero).

RESULTS
The overall program evaluation survey was returned by 120 of the 127 registrants. The program received average scores of 4.45 for “achieving educational objectives,” 4.59 for “providing information likely to have an impact on the registrant’s practice,” and 4.78 for “teaching new information and/or verifying important information” (each based on a 5-point scale, with 5 being “strongly agree” and 1 being “strongly disagree”).

Among the 27 participants enrolled in the evaluation of knowledge retention, the mean pre-test score was 3.92 (standard deviation [SD] 1.71). On the post-test immediately following the program, the average score was 6.35 (SD 1.67). The average immediate score gain was 2.55 points (SD 1.93, P < .0001 for the signed rank test). One month following the program, the average score on the first retention test was 8.47 (SD 1.13), with the average subject having gained 5.36 points from the pretest (SD 1.28, P = .0002). Six months following the program, the average post-test score was 6.47 (SD 1.25), with the average subject having retained a score gain of 3.29 points from the pretest (SD 2.33, P = .001). However, after 6 months participants appeared to have lost the incremental knowledge score gains that had been seen at 1 month, with the mean difference from post-test to 6-month retention test being 0.27 (SD 1.53, P = .55) (Figure).

DISCUSSION
Many investigators have reported that CME programs fail to impart knowledge and skills that physicians remember long-term and integrate into their daily practices. Over the last 50 years, cognitive psychologists have elucidated basic learning theory that suggests that this failure of CME may be a consequence of its reliance on traditional classroom
didactic methods [8]. At least 3 components of this cognitive theory appear inadequately addressed by traditional CME and could be contributing to its shortcomings: the importance of elapsed time in consolidating learning, the role of a realistic learning environment for achieving transfer into practice, and the importance of believable feedback in breaking down overconfidence.

Cognitive theory proposes that when one learns a fact or concept, a “trace” of the experience remains in one’s memory. Each memory trace has an “activation strength” that becomes a key factor in the ability to recall the memory. As time passes after formation of the memory, the activation strength tends to fade. Studying or rehearsing a memory increases its strength, but a key unintuitive aspect of cognitive theory is that the strength increase lasts longer (and, thus, the retention of learning is greater) when rehearsal is spaced over time rather than being massed into a single session [9].

Another important factor in the effectiveness of training is the facility with which learners can transfer new knowledge into practice [10]. The greater the mismatch between the training environment and the practice environment, the greater the likelihood that the training will produce “inert knowledge” less capable of impacting subsequent performance.

A third cognitive difficulty arises from the fact that learners often become overconfident about their knowledge, and this overconfidence inhibits their motivation to learn new material. The provision of individual feedback before and after a learning activity is a helpful method for learning and achieving accurate self-assessments.

Continuing medical education has rarely applied these principles of cognitive theory. Traditional CME programming has generally relied on the single presentation of relatively large amounts of information massed into one session at a location distant from the participant’s practice, with little or no delayed reinforcement [11]. Although an efficient and relatively inexpensive vehicle for informing physicians about the current state of medical knowledge, its educational shortcomings are well documented.

Applying the adage “students will learn what will be tested on” [6], this pilot study found good learning acquisition and retention in CME participants’ fulfilling a commitment to engage in point-in-time tests administered prior to as well as at varying times after the learning activity. This assessment strategy addressed, at least in part, 3 aspects of cognitive learning theory wholly neglected by the traditional CME format. By its facilitation of the process of “rehearsal,” serial cognitive testing at varying times following the learning activity appeared to enhance retention of at least some of the learning experience. Although one would be hardpressed to view the completion of a post-test as forging a meaningful link between the training and practice environment, it nevertheless represents a closer link than a CME program conducted at a location remote from the physician’s everyday environment. Finally, the use of pre-tests and post-tests provides the learner instruments for self-assessment over time, potentially reducing the risk of overconfidence on the part of the learner.

There are numerous limitations to this pilot study. First, the study group was small, and its findings were limited to participants in a single CME course. The lack of a control group raises questions as to whether factors apart from the intervention were responsible for the learning retention demonstrated. For example, it is possible that those course registrants inclined to volunteer for the testing protocol might be more serious and conscientious learners who would have demonstrated knowledge acquisition and retention regardless of the post-test learning intervention. Despite suggesting possible benefit of a longitudinal point-in-time test strategy on long-term changes in knowledge retention, this study does not provide any measure of the impact of this knowledge on physician behavior or healthcare outcomes. Finally, this study provides no information on the optimal timing for learning reinforcement by use of post-tests and/or other assessment interventions.

In summary, this pilot study suggests that the inclusion of point-in-time tests administered prior to and longitudinally following an activity holds the potential for improving the educational effectiveness of traditional CME activities. By extending the temporal and geographic venue of the educational activity, such a strategy is more in keeping with principles of cognitive learning theory for promoting long-term learning retention. It is hoped that in the near future the study can be expanded.

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![Graph showing test scores over time](image)

Scores at each point in time before and after the course. The mean scores for each test are shown as square points, with the inter-quartile range (25th to 75th percentiles) denoted by the lines extending vertically from each point.
by making use of the internet to administer the post-tests, providing longitudinal adjunctive computer-assisted instruction (ie, patient simulator systems), and gauging the impact on physician performance at a time remote from the original learning experience.

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