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Original Article

Unanticipated Learning Outcomes Associated with Commitment to Change in Continuing Medical Education

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Abstract

Introduction: *Educator-derived, predetermined instructional objectives are integral to the traditional instructional model and form the linkage between instructional design and postinstruction evaluation. The traditional model does not consider unanticipated learning outcomes. We explored the contribution of learner-identified desired outcomes compared with learner outcomes that were not named in the instructional design.*

Method: *This study was conducted at a short course in pediatrics in which 43 physicians, advanced practice nurses, nurses, and physician assistants voluntarily self-identified committed-to changes (CTCs). We compared these CTC predicates with the predetermined instructional objectives that had been published in advance in the conference brochure and syllabus. CTCs whose predicates described the same features as the instructional objectives were considered to be anticipated learning outcomes. CTCs lacking correspondence with instructional objectives were considered to represent unanticipated learning outcomes.*

Results: *Of the 157 CTCs, 68% were anticipated learning outcomes because their predicates could be linked to the instructional objectives. The remaining 32% of CTCs did not correspond to any of the instructional objectives and thus represented unanticipated learning outcomes.*

Discussion: *These findings demonstrate that evaluations based on instructional objectives, although valuable, are incomplete because educational activities may also stimulate many unanticipated learning outcomes. Continuing medical education planners can gain a fuller assessment of the effect of their educational endeavors by including predetermined instructional objectives and encouraging the constructivist practice of recognizing unanticipated learning.*

Key Words: Commitment to change, constructivist, continuing medical education (CME), evaluation, instructional objectives, learning outcomes, unanticipated learning outcomes

Introduction

An assessment of learning should be an integral component of any educational curriculum to discern the merit of the instructional process and/or the value of the educational product. In general, adult educators use evaluative models that were developed for secondary school or higher education classroom settings and adapted for adult learners.[1] In practice, the pervasive evaluation approach

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for assessing educational effectiveness in learners of all ages usually relies on instructor-derived, instructional objectives, based on a model initially proposed five decades ago by Ralph W. Tyler.[2] The steps in the Tyler rationale are (1) assessment of learning needs; (2) determination of instructional objectives; (3) development of instructional materials, methods, and resources to enable attainment of the objectives; and (4) evaluation of learners' progress in relation to objectives. Tyler's approach has the ability to measure behavioral change. Mager enhanced the model by clarifying that an objective should describe a performance, outline the conditions under which the performance is to occur, and describe the criteria for acceptable performance.[3] Adapting the strategies of Tyler and Mager, the educational planners of formal learning activities have used the learner's commitment to change as a means to encourage and measure expected accomplishments.[4]

If one accepts the definition of evaluation as "the systematic collection of evidence to determine if the desired changes are taking place,"[5] then it stands to reason that both the instructional designer and the adult learner have a stake in naming the desired changes and identifying which changes actually have taken place. The effectiveness of the Tylerian model on commitment to change of medical practitioners has been evaluated in the studies of continuing medical education (CME) providers. Purkis[6] asked physicians at a CME course to commit to specific practice changes, surveyed them 2 months later, and concluded that self-reports were indicators of change of practice. Jones[7] showed that the committted-to change (CTC) focuses the learner's attention on specific learning needs, facilitates goal setting, and gives CME providers a definition of program effectiveness. Parker and Mazmanian[8] concluded that the power of commitment might be an important instrument for facilitating successful change.

According to Driscoll,[9] constructivist theories of instruction rest on the assumption that to engage in meaningful activity, knowledge is constructed by the learners as they attempt to make sense of their experiences. When adult learners attend CME activities, they bring a matrix of their own lifetime experiences and schema. Several ways in which learners may validate their understandings include questioning the speakers, clarifying understandings through discussions with peers, and exchanging practice tips with colleagues.[10] Their understanding of the world is not a passive reception of preexisting objectives but a relational process of creation, whereby the search for knowledge involves interaction with environmental influences, schema, and a need for solutions to practical problems.[11]

Egan[12] recognized that CTCs can function as a sensitive and specific assay for measuring CME-induced changes. CTCs are the products resulting from the learner's judgment of importance coupled with active filtering of key issues from the program material. CTCs are a means for assaying the match or mismatch between the instructor-derived objectives and learner outcomes, forming a tool for increasing the effectiveness of the educational intervention or for refocusing the direction of evaluation. In this article, we explore the number of learner-identified desired outcomes that were linked to predetermined instructional objectives compared with learner outcomes that were not named in the instructional design. Our investigation used learners' CTCs because the responses were self-identified outcomes that resulted from the learning process. These outcomes can be compared to determine whether they correspond to the instructional objectives. Conversely, those CTCs lacking correspondence with the instructional objectives represent unanticipated learning outcomes. The present study was part of an investigation into the commitment to change strategy.[13] Both studies were associated with a 3-day regional CME meeting.

Materials and Method

The course included 12 45-minute lectures and 3 45-minute breakout sessions divided so that

each day of instruction comprised 4 podium presentations and a breakout session. There were 29 predetermined instructional objectives (range 1–4 per presentation) that had been created jointly by the planning committee, which included pediatricians, family practitioners, and advanced practice nurses. Each objective was printed in the preconference brochure and syllabus. Of the 61 conference attendees, 28 (46%) were physicians (pediatricians and family practitioners), 8 (13%) were advanced practice nurses (nurse practitioners), 22 (36%) were nurses (registered nurses and licensed practical nurses), and 3 (5%) were physician assistants. At the opening of the conference, prior to any presentations, attendees were invited to participate in a study of changes resulting from learning during the presentations. Each registrant received a blank form consisting of four numbered areas, a space for the participant's name, and a check box for identifying profession. Participation was optional. Those who chose to participate were asked to self-identify and at any time during the course write on the form the changes they intended to make or to influence others to make in the delivery of care to children and adolescents. Nothing further was offered to guide the audience in the scope or content of their responses.

A CTC was considered to be related to the predetermined instructional objective if their predicates described the same features. If the object of a CTC's predicate matched the object of one of the predetermined instructional objectives, that CTC was defined as linked and was considered to represent an anticipated learning outcome. For example, for a CTC to be categorized as being linked to the predetermined learning objective of "more effectively choose alternative antimicrobial agents," it had to address antibiotic selection (Appendix). Other aspects, including duration of therapy, diagnosis (otoscopy and tympanocentesis), or parent education, were categorized as unlinked because they did not address antibiotic selection. Categorization was made by one of the authors (J.L.D.).

Results

Forty-three (70%) of the attendees submitted a total of 157 CTCs (mean 3.7 CTCs per participant). One hundred six (68%) of the CTCs contained a predicate phrase that addressed one of the predetermined instructional objectives, and 51 (32%) of the CTCs did not link to any of the predetermined instructional objectives. One or more CTCs could be related to 19 of these objectives (range 1–20). There were no CTCs for 10 (34%) of these objectives.

Discussion

Slightly more than two-thirds of the CTCs were anticipated learning outcomes, suggesting that the Tylerian model worked well. However, almost one-third (32%) of the self-identified CTCs were not precisely related to any of the instructional objectives and appeared to represent learning outcomes that the Tylerian model did not anticipate. Nearly two-thirds (66%) of the predetermined instructional objectives stimulated at least one CTC, but there was no CTC listed for slightly greater than one-third (34%) of the instructional objectives. The objectives without linkage to CTCs were often conceptual in nature or dealt with the underlying biology. These instructional objectives reflect the perceived need by the faculty-experts for depth or breadth, even though such objectives may not be directly actionable for delivery of clinical care. It seems unlikely that a maximum of four instructional objectives per presentation was excessive, recognizing how Miller[14] showed that humans can accurately discriminate among five to nine different choices.

The commitment to change strategy has been used to examine barriers to change[15] and behavioral changes occurring in the absence of an initial intent.[4,16] We have now applied the technique to evaluating instructional design. We know of no prior studies in CME linking behavioral change to instructional objectives as asserted through the Tyler model.

The high frequency of unanticipated outcomes could be partly attributed to three factors. First, the learner's specific domain related to prior knowledge enhances and improves acquisition of new domain-related information. Without this available knowledge or schema, new information cannot be integrated and is therefore lost.[17] Second, if the CME objectives themselves are written from the perspective of the planners rather than the learners, they may provide only ready-made solutions. However, what is not taken into account in this process is that the learning of medical practitioners is intertwined with their ongoing practice, making it likely that what they learn will be adapted to influence and support their own practice in meaningful ways.[18]

Third, the instructional objectives communicate the planners' intent of instruction[19] to a heterogeneous audience (in this case, pediatricians, family physicians, advanced practice nurses, registered nurses, licensed practical nurses, and physician assistants). Instructional objectives were deliberately worded broadly enough to be applicable to those learners whose prior requisite knowledge is insufficient for application of information. Of the 32% of learners who developed unanticipated learning outcomes, 6 were physicians and 4 were advanced practice nurses, registered nurses, or licensed practical nurses whose requisite knowledge, experience, professional responsibilities, and authority enabled them to explicitly link concepts, professional activity, and learning outcomes. These CTCs were personalized and individualized and were more complex and specific than the predetermined instructional objectives. This group of learners brought to the CME activity their own cognitive systems of necessary knowledge, metacognitive thinking, and keen analytic skills[20] to engage in new tasks beyond the planners' goals and objectives. Had there been a greater number of instructional objectives, it still would have been impossible for CME planners to develop objectives that fully anticipate all of the learning that took place.[21]

Lessons for Practice

- Learners frequently modify and adjust instructor-derived instructional objectives by interpreting and adapting their new knowledge with consideration for previous life experiences.
- Instructional objectives are important but do not necessarily account for all of the learning and behavioral changes that have occurred.
- Evaluation based on instructional objectives elevates in importance behaviorally based and measurable learning outcomes compared with outcomes that may be more difficult to measure.
- Continuing medical education planners can gain a fuller assessment of the effect of their educational endeavors by including instructional objectives and encouraging evaluation of unanticipated learning.

As Brookfield noted, the Tylerian model may be suitable for instruction involving technical topics and psychomotor skills but does not work well for nontechnical learning, such as when the learner is seeking meaning, is engaged in self-reflection, or is reflecting on experience.[1] The process of seeking new meaning is exemplified in one of the CTCs: "I will *really try* to use more pneumatic otoscopy in my practice than I do now" (see Appendix). Rather than acquiring new factual information or new skills, the learner developed new meaning for the importance of an existing skill. This transformation went beyond the scope of any of the predetermined instructional objectives because none were even tangentially concerned with the diagnostic technique of pneumatic otoscopy.

CTCs were explicit markers that learners wanted to try out new knowledge and skills in practice. Of course, it should not be assumed that all intended practice applications end up as written CTCs.

A more informed understanding of the adult learner has emerged since Tyler's rationale was first published. Knowles et al.'s andragogic model has much in common with the constructivist view that learners construct meanings from the matrix of previous knowledge and present experience.[5] In Knowles et al.'s andragogic model, preexisting experience is valued as rich research for learning. Learning is life centered and task centered rather than subject centered. Our data show that 70% of the attendees created CTCs, all of which were task centered and referred to their professional role as health care workers. Our study was not designed to provide insight into any of Knowles et al.'s other assumptions (self-directedness of the adult learner, value of previous experience, readiness to learn stimulated by a need to know, immediacy of application of new knowledge).

Implications for CME Planners

With the exception of a limited number of state-specific requirements for medical relicensure, there is no precisely defined knowledge set for physicians engaging in CME. At this stage in their professional development, learners engaged in CME are responding to self-perceived learning needs rather than striving to achieve mastery of externally derived instructional objectives. Educational planners should consider the broader scope of how the learner may personalize and incorporate new knowledge into the context of her/his professional practice, and further research must be done to study the individual components of CTCs as well.[4]

CME planners, evaluators, and policy makers need to be aware of how the Tylerian approach can constrain the choice of factors used to reflect educational effectiveness. Linking learning outcomes to instructional objectives inherently causes educators to judge their success based on achievement of measurable indicators. Further studies are necessary to better explain the factors that cause practitioners to go beyond the limited goals of planned commitment to change. If the specified change and commitment are consistent with the physicians' beliefs and desires, one might expect change.[16] The physician's beliefs and desires might go beyond the planned objectives of the CME activity and lead to unanticipated changes of practice.

Instructional objectives are important but do not necessarily account for all of the learning that occurred. Unanticipated, incidental, or serendipitous learning can have important effects. This should not be interpreted to mean that the Tylerian model has been invalidated. Instead, CME planners can gain a fuller assessment of the effect of their educational endeavors by including instructional objectives and encouraging the constructivist practice of unanticipated learning. As Albert Einstein once said, "Not everything that can be counted counts, and not everything that counts can be counted."[22]

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Appendix Examples of Linkage between Instructional Objectives and Committed-to Changes

Presentation	Predetermined Instructional Objectives	CTC*
Otitis Media and Sinusitis in the Age of Emerging Resistance	More effectively choose alternative antimicrobial agents	Will prophylax OM with Gantrisin only
		Treating serous OM differently
		Will use amoxicillin more in first-line OM and not use Septra as a second-line agent
		Increase Amoxil dose to 80 mg/kg/d for acute OM
		Use higher doses of amoxicillin in OM
		Will use 80 mg/kg/d amoxicillin as a second line of treatment for acute OM failing amoxicillin 40 mg/kg
		Will use Augmentin or other β-lactamase–resistant antibiotic after 80 mg/kg/d amoxicillin fails
		Change use of amoxicillin including use of higher doses and fewer days of treatment, as appropriate
		Increase dose of amoxicillin and decrease use of Ceclor
		Make better second-line antibiotic choices: less Septra and Pediazole
		Discontinue use of macrolides in acute OM after amoxicillin; consider Augmetin, Ceftin, Suprax, Cedax, Vantin
		Judicious use of antibiotics; treatment of first acute OM, persistent-recurrent acute OM; treatment of suspected sinusitis
	Understand the important mechanisms of bacterial resistance to antibiotics	Better use of antibiotics for OM (i.e., 5 d of antibiotics) and better understanding of antibiotic resistance when choosing second-line antibiotics
	Describe the prevalence of antibiotic resistance among common pediatric respiratory pathogens	No CTCs
	Recognize the bacteriology, including importance of untypable *Haemophilus influenzae* in respiratory infections	
	No predetermined instructional objectives	Better recommendations to parents regarding treatment in at-risk and chronically ill children
		Consider using antibiotics for only 5 d in low-risk children in OM
		Try 5 d of antibiotics for acute OM in the older child
		Consider use of tympanocentesis over antibiotics or tubes for chronic OM
		Consider treating acute OM for 5 d instead of 10 d but will recheck in 5–7 d to be sure acute OM is gone and sinusitis for 10 d

		Will shorten my antibiotic course to 5 d for kids > 2 yr with acute OM
		Will really try to use more pneumatic otoscopy in my practice than I do now
		Recommend tympanocentesis earlier in course of unresolving acute OM; may learn how to do procedure
		Use pneumatic otoscopy
		Treatment for nonperforated OM 5 d
		Treatment for sinusitis 7 d beyond improvement; use 10 d mark to help guide treatment decision
Respiratory Syncytial Virus: Epidemiology, Pathogenesis, and Prevention	Identify appropriate candidates for RespiGam and Synagis for preventing RSV infections	Increased knowledge/safe practice of Synagis
		Use RSV monoclonal (antibodies) in premature babies < 35 wk EGA
		Careful evaluation of preterms for Synagis
		Increase use of immunotherapy to prevent RSV
		Will have more information to help my families make decisions about IVIG
		Recommend Synagis for "healthy" at-risk infants
		Synagis injections for < 35 wk gestation
		Better understand the new treatment for RSV and help identify patients in our clinic that are eligible for this treatment
	Describe the important microbiologic and immunologic aspects of RSV	No CTCs
	Describe the epidemiology and spread of RSV	
Prenatally Diagnosed Congenital Heart Disease: How Should We Advise Parents	Recognize and be able to better advise parents regarding the role for surgical correction of specific types of congenital heart disease	Will need to be more careful in listening to parents of patients who are postsurgery to repair congenital heart defects, screening blood pressure, etc.
		Inform families of left-sided heart lesions of 10%–20% recurrence
Enteroviral Infections in Infancy	Be aware of diagnostic and treatment options for enteroviral infection	Educate coworkers in regard to enterovirus detection and treatment recommendations
		Send PCR sample for enterovirus to Salt Lake City
		Start using enteroviral PCR in evaluation of febrile infants
		Use PCR to diagnose enteroviral infections in infants
	Recognize the clinical syndromes associated with enteroviral infections in infancy	No CTCs
	Understand the importance of enteroviral infections in febrile infants undergoing an evaluation for sepsis	
Acne	Select an appropriate treatment regimen for acne treatment	Begin using a combination of treatment approaches for acne
		Treat infantile acne

	Council school teens in skin care—better understanding of acne and its treatment; education myths of acne
	Managing acne
	Use newer agents in the treatment of acne
	Manage acne more effectively
	Fine-tune acne management
	Use Retin-A more readily for acne
	Better equipped to answer questions and teach adolescent patients with acne
	Better approach to treating acne
	Decrease referrals to dermatologists for acne
	Treatment of acne using combination topical approach and combination with oral antibiotics depending on the degree of acne
Identify patients who should be referred for specialty care	Decreasing referrals to dermatologists

*See Appendix Table 1 for corresponding generic and trade names.
CTC = committed-to change; EGA = estimated gestational age; IVIG = intravenous immunoglobulin; OM = otitis media; PCR = polymerase chain reaction; RSV = respiratory syncytial virus.

Appendix Table 1 Medication Trade Name and Corresponding Generic Name

Trade Name	Generic Name
Amoxil	Amoxicillin
Augmentin	Amoxicillin/clavulanate
Cedax	Ceftibuten
Ceclor	Cefaclor
Ceftin	Cefuroxime axetil
Gantrisin	Sulfisoxazole
Pediazole	Erythromycin ethylsuccinate/sulfisoxazole
RespiGam	Respiratory syncytial virus immune globulin intravenous (human)
Retin-A	Tretinoin
Septra	Trimethoprim/ sulfamethoxazole
Suprax	Cefixime
Synagis	Palivizumab
Vantin	Cefpodoxime