Evaluating a Competency-Based Blended Health Professions Education Program: A Programmatic Approach

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ABSTRACT

Introduction:

Competency-based education (CBE) programs usually evaluate student learning outcomes at a course level. However, a more comprehensive evaluation of student achievement of competencies requires evaluation at a programmatic level across all courses. There is currently insufficient literature on accomplishing this type of evaluation. In this article, we present an evaluation strategy adopted by the competency-based master's degree program at the Center for Health Professions Education at the Uniformed Services University of Health Sciences to assess student achievement of competencies. We hypothesized that (1) learners would grow in the competencies through their time in the program and (2) learners would exhibit a behavioristic change as a result of their participation in the program.

Materials and Methods:

The degree program at the Center for Health Professions Education conducts an annual student self-assessment of competencies using a competency survey. The competency survey data from graduated master's students were collected, providing data from three time points: initial (pre-program survey), middle, and final (end-of-program survey). Open-ended responses from these three surveys were also analyzed. A general linear model for repeated measures was conducted. Significant effects were followed by post hoc tests across time. We also conducted post hoc analysis across domains to better understand the comparative levels of the domains at each time point. The responses to the open-ended prompt were thematically analyzed.

Results:

Analysis of the quantitative data revealed that (1) learners reported significant growth across time, (2) learners had different perceptions of their competencies in each of the domains, and (3) not all domains experienced similar changes over time. Analysis of the free responses highlighted the impact of coursework on competency attainment and the behavioristic change in learners.

Conclusions:

This study presents a strategic evaluation tool for course-based CBE programs that follow a traditional credit hour model. Programmatic evaluation of CBE programs should enable the inclusion of the learner's voice and provide evaluation data that go beyond individual course evaluations.

INTRODUCTION

Although the roots of competency-based education (CBE) can be traced back to the Morrill Land Acts of 1862, CBE gained prominence in medical education when the American Association of Medical Colleges advocated for CBE and the Accreditation Council for Graduate Medical Education and the American Board of Medical Specialties jointly developed competencies for certification.[1,2] All levels of medical education, undergraduate medical education, graduate medical education, and health professions education (HPE), have adopted CBE in various ways.[3,4] In HPE, many master's HPE programs are "competency-based educational experiences that focus on the theory, research, and practice of education as it applies to health professions environments."[5]

Graduate programs in HPE aim to transform a competent clinician into an academic leader.[5] To ascertain that these outcomes are met, rigorous program evaluation is required.[3] Many graduate HPE programs are offered in a blended or online format, and evaluation is critical to ensure that program goals are met in these distanced environments.

CBE programs usually evaluate student learning outcomes at a course level.[6] However, a more comprehensive evaluation of student achievement of competencies requires evaluation at a programmatic level across all courses.[6] Although there are studies on the evaluation of competency-based medical education,[3,7,8] there are currently no studies on implementing a comprehensive programmatic evaluation of competency-based HPE programs. In this article, we present an evaluation strategy adopted by the competency-based degree program at the Center for Health Professions Education (CHPE) at the Uniformed Services University of Health Sciences (USU) to assess student achievement of competencies.

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We hypothesized that (1) learners would grow in the competencies through their time in the program and (2) learners would exhibit a behavioristic change as a result of their participation in the program.

CONTEXTUAL FRAMEWORK

CBE Model

The CHPE at the USU uses a course-based competency model to provide CBE to degree-seeking health professionals. Four broad models of CBE programs are recognized by the Experimental Sites Initiative Title IV federal funding program: (1) The course-based CBE model is very similar to the traditional higher education model, where successful completion of a program requires a specific number of credits that are associated with predetermined credit hours. The program objectives are directed by identified competencies. (2) Direct assessment-based CBE and (3) prior learning assessment–based CBE programs remove time constraints and gauge achievement of competencies through various assessments within the program and prior experiences outside the program. (4) Finally, a hybrid model includes course-based CBE and direct assessment or prior learning assessments in various combinations.[9] The certificate and degree programs at the CHPE are based on the course-based CBE model to satisfy university and federal funding requirements. This model does not include the self-paced, time-independent element of other CBE models, such as the direct or prior learning assessment models.

The CHPE program is built on three competency domains: Leadership, Education, and Research to prepare clinicians for positions of academic leadership.[5] Within each domain, several individual competencies have been identified (see Table I).

Evaluating CBE Programs

There are many program evaluation models, and some, such as contribution analysis, have been explicitly proposed for competency-based medical education programs.[3,10] When evaluating CBE programs, real-world relevance and behavior change are two key expected outcomes. Therefore, CBE tends to measure observable outcomes.[11] This is a limited behavioristic approach that ignores more nuanced learning that occurs.[11] Furthermore, these evaluations tend to happen at discrete course levels rather than across all courses at a programmatic level.[6]

One suggestion to address these limitations is conducting regular student self-assessments.[6] CBE programs are unique in their focus on outcomes and their prioritizing of the learner, wherein learners are engaged in an assessment of their progress through regular self-assessments.[12] The program evaluation of CBE courses must incorporate these self-assessments to be comprehensive. This enables a more global evaluation of the program and reveals other forms of learning. Self-assessment allows learners to reflect on their personal growth and engenders self-efficacy. This is important because people's interpretation of their performance affects their self-belief and ultimately influences subsequent performance.[13] Research also suggests that students' sense of self-efficacy predicts motivation to act rather than competence alone.[14]

The master's program at the CHPE conducts an annual student self-assessment of competencies, starting with an initial preprogram self-assessment and ending with an end-of-program self-assessment. The CHPE master's program timeline allows for three self-assessments to be conducted, including one completed during the program.

TABLE I. CHPE Competency Model

Leadership	Education	Research
Reflect on practice	Develop teaching philosophy	Review scholarship
Collaborate in teams	Apply teaching methods	Apply theory
Apply leadership theory	Develop curriculum	Defend research
Negotiate and resolve	Assess learners	Design research
Mentor and develop	Evaluate programs	Disseminate scholarship
	Teach with technology	Write grants
		Research ethically

Abbreviation: CHPE, Center for Health Professions Education.

METHODOLOGY

Survey Instrument

The HPE competency survey is an 18-item Likert survey where learners are asked to self-reflect on their current abilities in multiple competencies under the three primary competency domains of Research, Leadership, and Education (see Table I). Learners rank their competencies as Basic, Intermediate, Advanced, or Mastery. To help learners appropriately select the most appropriate category, the survey introduction includes behavior anchors for each category (see Table II). Learners are also given an open-ended prompt, "Describe how you have grown in HPE competencies and areas where you would like to focus your growth." Domain competency across the three programmatic competency domains of Education, Leadership, and Research was calculated by averaging items within each domain.

Data Collection

For this retrospective study, competency survey data from graduated master's degree students were collected, de-identified, cleaned, and analyzed. This study was deemed exempt by our Institutional Review Board.

TABLE II. CHPE Competency Behavior Anchors

Basic (B) = I have been introduced to the topic and attain a basic knowledge and comprehension of the subject matter.
Intermediate (I) = I have practiced the competency and am able to do it with supervision.
Advanced (A) = I have comprehensive knowledge of the competency and am able to do it independently.
Mastery (M) = I have mastery of the competency and can teach others.
Not applicable (NA) = I have not been explicitly exposed to the competency.

Abbreviation: CHPE, Center for Health Professions Education.

TABLE III. Mean Scores Over Three Time Periods

	Initial		Middle		Final	
Domain	Mean	SD	Mean	SD	Mean	SD
Leadership	2.43	0.74	2.96	0.64	3.51	0.42
Research	1.51	0.54	2.05	0.68	2.81	0.47
Education	2.10	0.72	2.39	0.83	2.45	0.85

The dataset comprised three competency surveys, each from 22 learners who had graduated from the CHPE master's degree program. To assess each domain, the Likert scores were ranked from 1 to 4 (1 being Basic and 4 being Mastery), scores within each domain were summed, and a mean average for each domain was produced. Open-ended responses from these three surveys were also de-identified and compiled.

Data Analysis

A two-way repeated measures analysis of variance was conducted to determine if there were differences between the dependent variables time and domain. The significance level was set at $P < .05$. We tested the assumption of sphericity using Mauchly's test of sphericity (Mauchly's W) and used the Greenhouse–Geisser correction when the assumption was violated. Significant effects were followed by post hoc tests across time. We also conducted a post hoc analysis across domains to better understand the comparative levels of the domains at each time point. We estimated the reliability coefficients for each programmatic competency domain using Cronbach's α.

The responses to the open-ended prompt were thematically analyzed by the first author using Braun and Clarke's model.[15] The data were first organized into the three survey time points of the beginning, middle, and end of the program. Within these sections, the data were read and re-read to identify themes and subthemes. These themes were then compared to the quantitative findings and finalized by the first and last authors.

RESULTS

Quantitative Data Analysis

Descriptive statistics were calculated for gender, age, ethnicity, and profession. The average age of the learners was 44 years (SD 7.2). Twelve learners were identified as female (60%), and most were (86%, $n = 19$) identified as Caucasian, two as Asian (9%), and one as Latino/Hispanic (4.5%). All but one were physicians, the other being a clinical psychologist.

Reliability estimates for the three programmatic competency domains of Education, Leadership, and Research were calculated using Cronbach's α. The leadership domain encompasses competencies such as "Apply leadership theory" and "Mentor and develop." There are five leadership competencies that make up the domain score for leadership (Cronbach's $\alpha = .91$). In the Education domain, there are six competencies that produce the education score and include competencies like "Develop curriculum" and "Evaluate programs" (Cronbach's $\alpha = .95$). The Research domain has seven competencies including "Disseminate scholarship" and "Research ethically" (Cronbach's $\alpha = .94$).

The results of the two-way repeated analysis of variance revealed that the assumption of sphericity was violated for domain (Mauchly's $W = 0.7$, $\chi^2 = 7.1$, $P = .029$) as well as for the interaction term (time × domain, Mauchly's $W = 0.137$, $\chi^2 = 38.62$, $P < .001$) significant main effect for time; both domains were interpreted using the Greenhouse–Geisser correction. We found significant findings for all effects. Scores demonstrated an overall significant main effect over time ($F(2, 42) = 33.01$, $P < .001$, $\eta^2 = 0.758$). The overall scores for domain also demonstrated a significant main effect ($F(1.54, 42) = 20.01$, $P < .001$, $\eta^2 = 0.49$). Finally, there was a significant interaction effect in our model ($F(2.06, 84) = 8.43$, $P < .001$, $\eta^2 = 0.29$). This interaction effect suggests that the main effects for time are not consistent across all domains. Table III presents the results of the multivariate tests.

Overall, we found that (1) learners reported significant growth across time, (2) learners had different perceptions of their competencies in each of the domains, and (3) not all domains experienced similar changes over time. Figure 1 highlights the interaction effect in our model. The Education domain sees an increase from the preprogram to the mid-point of the program; however, the results plateau from the mid-point to the end of program. The Leadership and Research domains account for most of the changes in competencies.

The Research domain started with the lowest initial self-rating (1.5 and would be described as Basic as described in the survey as "I have been introduced to the topic and attain a basic knowledge of the subject"). Learners appeared to undergo the most change across time in the Research domain going from the initial to the final survey (mean change score of 1.3). Learners reported their research competencies moving from a Basic understanding to an Intermediate and almost Advanced competency.

Leadership competency was the highest initial rating and remained so over time. Over time, the change was slightly

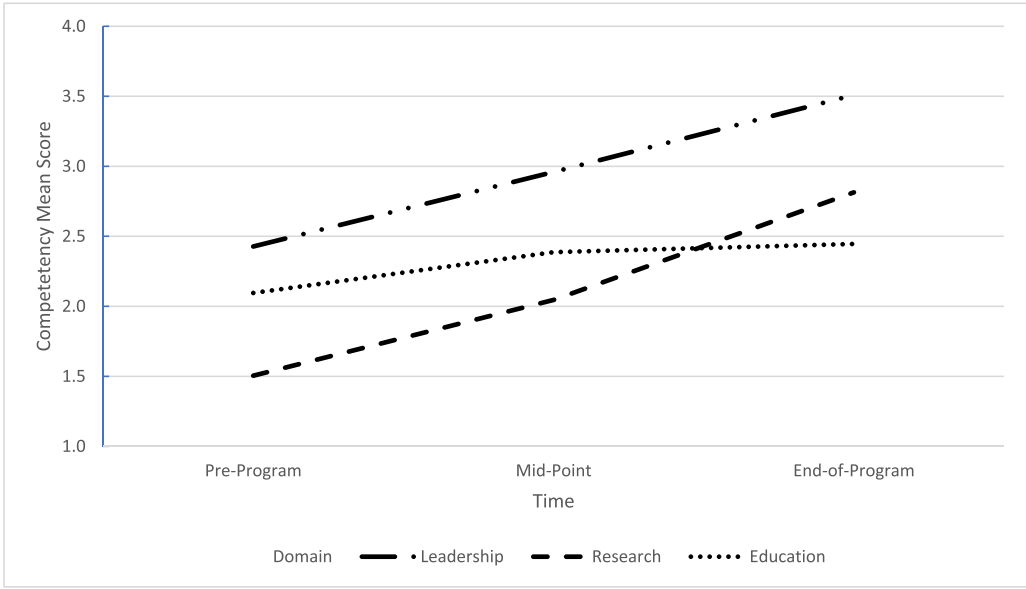

FIGURE 1. Domain scores over academic periods of time.

less than what was seen in Research (1.18 mean change score) with learners going from an Intermediate competency level to an Advanced level. Education showed the least amount of change over time and seemed to stay at the Intermediate level with only a slight improvement over three time periods.

Qualitative Data Analysis

The textual free responses were analyzed to see if they could provide more insight into the findings from the quantitative analysis. Three themes emerged: (1) normalizing of self-assessment scores, (2) impact of coursework on competency attainment, and (3) putting theory to practice. The normalization of self-assessment scores primarily occurred at the middle-point self-assessment. In the middle-point and final self-assessments, the impact of coursework on competency attainment and the ability to put theory to practice were noted.

In the middle-point self-assessment, on the same competency measure, learners marked themselves lower than they had in the initial survey. They explained this change as "I realize there is a lot more involved than I previously thought," and "Sometimes you don't know what you don't know." As learners engaged in the coursework, they realized that they probably overestimated their competence in the initial survey. One learner stated, "I had previously placed myself at 'advanced' in my abilities, but I think that was a gross overestimate." By the middle-point survey, there was a normalization of self-assessments.

Learners explicitly connected coursework to specific competencies they had achieved. Learners noted, "My coursework has been tremendously helpful in moving me to the right on these scales" (from Basic toward Advanced and Mastery) and "Since taking the leadership theory course, I think I am more critical of my leadership skills than I was a year ago." Similarly, another learner noted, "I feel that the coursework has allowed me to have a greater understanding of the areas in which I might continue to improve." One learner said, "I also believe, however, that my growth in this area was supported by my coursework in MED 504, MED 550, and my practicum work of having an HPE instructor assist with critical review of a workshop that I presented."

In a true measure of the success of a CBE program, learners indicated that they were actively applying their learned skills into practice. One learner said, "My approach to the process of leadership has changed significantly over the past 2 years." Another learner claimed, "I am finding that I am already subconsciously applying these lessons in my day-to-day activity." Furthermore, learners saw an impact on their broader educational journey: "The MHPE coursework has clearly increased my knowledge base giving me the foundation and confidence to continue to independently pursue my personal HPE growth beyond completion of this program."

DISCUSSION

For this holistic programmatic evaluation, we hypothesized that (1) learners would grow in the competencies through their time in the program and (2) learners would exhibit a behavioristic change as a result of their participation in the program. We analyzed student self-assessment of competencies at three time points in a competency-based program—the beginning of the program, in the middle, and at the end of the program to test our hypothesis. Analysis of quantitative and qualitative data highlighted the value of conducting global self-assessments in a CBE program. A review of the

data showed that students perceived an overall change in their competencies in the expected directions. From a program perspective, this feedback is valuable as it provides evidence that the courses in the program are aligned with the competencies, thereby enabling learners to achieve the requisite competencies.

The close alignment between courses and competencies was expected, specifically the increase in the Education competency scores between the beginning time point and the middle time point. It is during this year that learners take courses focused on education. Similarly, the increase in the Leadership and Research competency scores from the middle point to the end of the program is expected as learners take more Leadership and Research courses in this time frame. They also participate in more research-oriented activities. Research in HPE is generally unfamiliar to learners from health professions fields, and they begin by self-assessing at a Basic level. The move to the Mastery and Advanced levels is expected as degree learners are required to publish a peer-reviewed journal article to meet graduation requirements.

The differences in scores across the competencies suggest that there is likely sufficient granularity in the competencies. A level of detail is needed for learners to be able to self-assess successfully. Competencies that are too general are not likely to be helpful. At the same time, the competencies need to be broad enough to encompass different activities. Students identified behavioral changes as a result of the program, providing the ultimate validation of a CBE program.[11]

Self-assessments are valuable tools to gauge the self-efficacy that learners feel. However, there is criticism of self-assessments in that learners have biased views of their abilities.[16] This was observed in the middle-point self-assessments where learners recognized that they had often exaggerated their competency levels at the beginning of the program. However, the learners reevaluated themselves lower in the middle-point assessments to reflect their true capabilities. Self-assessments are best used to enable learners to identify their strengths and weaknesses.[17] In this study, learners used the self-assessment as a reflective tool to critically assess themselves.

Although it is essential to evaluate competencies at the individual course level, from a programmatic perspective, it is important to conduct comprehensive evaluations of competencies across all courses in the program. Our findings show that comprehensive, programmatic student self-assessment of competencies can be effective in gathering validity evidence for student achievement of competencies. Moreover, student responses revealed that there was a behavioristic change as a result of the program. The competencies of our HPE program have prepared learners for the demands of the workplace and the requirements of lifelong learning.[11]

The evaluation of theoretical competency models is rare.[6] Through this study, we were able to gather validity evidence for our competency model. Although a key outcome expectation of CBE programs is the real-world applicability of learning, it remains a lingering challenge.[2,11] Findings from this study, however, provide concrete examples of how learners have transferred their learning to functional applications. The HPE competencies are, therefore, also shown to be relevant to the workplace and aligned with workplace needs.[11]

As with all research, there are limitations to this study. Although our sample size was small, Cronbach's α values for all three domains remained above .9, indicating a high degree of internal consistency for items in each domain. This study depended on self-assessments from learners. We acknowledge that self-assessments are not optimal tools. However, it should be noted that they are recommended as an evaluation tool for CBE programs.[6]

This evaluation has provided a starting point, but more research needs to be done. For example, competencies that show the least growth can be identified and used to assess the courses offered and their course objectives. The self-assessment component can also be enhanced by providing learners with individual coaches to review the survey and identify areas for growth. Further research on competency self-measurement is necessary to better understand the homogeneity of the items, the dimensionality of the proposed factors, and the relationship of the items between factors.

CBE can be constrained by institutional and organizational policies that limit flexibility.[6,11] This study presents a strategic evaluation tool for course-based CBE programs that follow a traditional credit hour model. Programmatic assessment should enable the inclusion of the learner's voice and provide evaluation data that go beyond individual course evaluations. The evaluation strategy presented in this article has a simple implementation and could potentially be applied to different CBE programs.

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest.

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