Moving Past Time as the Criteria: The Application of Capabilities-Based Educational Equivalency Units in Education

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Introduction

For nearly a century, the standard for determining the equivalency of academic courses and degrees has relied on time in the classroom as the primary indicator. Though widely accepted and convenient, time as the standard (i.e., the Carnegie unit) offers little utility for today's institutions of higher education. With the introduction and proliferation of instructional technologies and distance education, equivalency based on time in the classroom is of minimal relevance to students and instructors who supplement educational opportunities through technology (e.g., asynchronous online discussions, computer-based instruction). Unfortunately, proposed alternative models of equivalency that merely build complex relationships between new delivery systems and the conventional standard (e.g., two hours of interactive chat equals one hour in the classroom) will only continue to strengthen the misperception that time-in-the-classroom or time-on-the-Internet is the goal of instruction (Watkins & Schlosser, 2000a).

Though the application of the Carnegie Unit standard remains the primary benchmark for most American educational institutions, the Capabilities-Based Educational Equivalency (CBEE) Units model offers a pragmatic alternative for institutions that wish to be responsive to the changing characteristics of higher education (see Watkins & Schlosser, 2000a, 2000b). While allowing time and location to vary across courses and degrees, the CBEE Units approach permits the valid and useful comparison of student achievement by holding student capabilities relatively constant. The CBEE Units approach focuses the determination of equivalency on the capabilities-based objectives (see Gagne, 1991, 1977) rather than time in the classroom. This article will spotlight how this new approach to academic equivalency is being applied within a graduate program of a leading dual-mode university (i.e., a distance education and conventional classroom institution).

Educational Equivalency

In 1909, while defining what constitutes a college, the board of the Carnegie Foundation for the Advancement of Teaching established a standardized measure of academic equivalency. As Johnsen and Taylor (1995) noted, this definition "was based on the establishment of a unit of academic work based on time." According to the board's definition, a standard of 750 minutes with a qualified instructor equaled one academic credit hour, or Carnegie Unit. The Carnegie Unit has since become the standard of academic accreditation and equivalency.

In the last 25 years, however, the time-based standard of equivalency has lost much of its applicability in higher education. With the growing development of alternatives to the conventional lecture (e.g., online courses, supplemental internet chats, simulations), coupled with the growth in the number of non-traditional students, educational practices within many institutions have shifted away from a dependence on the classroom. At many colleges and universities today, instructors and students are less likely to spend three one-hour sessions in the classroom for fifteen weeks than they are to supplement their classroom time with online discussion groups, Internet chats with the instructor, and/or a variety of technology-driven instructional tactics. Therefore, the question of educational equivalence has become of increasing concern as students and faculty compare conventional and non-conventional instruction.

For educational institutions that desire to meet the demands of students, as well as of parents and employers, the basis of education equivalency must shift from a focus on time (whether in the classroom or on the Internet) to a consistency of capabilities of "passed" or "graduated" students. Many accrediting associations have also recognized this shift and demonstrated

their commitment to achievement-focused education by maintaining "outcomes-driven" criteria for assessment and evaluation (see The Commission on Colleges, Southeastern Association of Colleges and Schools, 1997, 2000). In the near future, the accreditation of courses and degrees will likely require demonstration that learning results (and objectives) are appropriate to the rigor and extensiveness of the credit hours awarded by the institution. A time-based model of equivalency will not empower institutions to meet these demands. The application of a CBEE Units approach, however, can better assure that results of conventional and non-conventional instruction are comparable.

Overview of the CBEE Units Approach

The CBEE Units model offers institutions an alternative to the development of complex relationships for aligning technology-mediated instruction to that of the traditional classroom. It offers an approach that is not time-dependent but is responsive to emerging technologies, supportive of systematic instructional design, and focused on the achievement of learners (Watkins & Schlosser, 2000a). Utilizing capabilities-based objectives (Gagne, 1991, 1977), the CBEE Units approach suggests a standardized formula for relating instructional objectives with academic credit. By assigning a unit value to the demonstration of human capabilities specified in Gagne's (1977) taxonomy, the equivalency model differentiates instructional objectives in relation to academic credit hours (see Table 1). Alternative taxonomies such as Bloom's (1956), Forshay's (1958), or Krathwohl, Bloom and Masia's (1964) may also be correlated with related to CBEE Units in future research.

With a proposed standard of 30 CBEE Units per academic credit hour, a determination of educational equivalency can be based on the attained knowledge and skills of learners (as specified by the instructional objectives of courses and degrees) rather than time in the classroom. By relating the number and scope of objectives to the credit hour value of a course, instructors (and instructional designers) are provided with an approximate benchmark when determining the scope and sequence of a course regardless of the instructional delivery system chosen.

Table 1: Human Capabilities and Proposed CBEE Units (Watkins & Schlosser, 2000a, 2000b)

Human Capabilities (Gagné, 1977)	**Objective Verb (Gagné, 1977)**	**CBEE Units per mastered competency**
Intellectual skills:		
Discrimination	Discriminates	1 unit
Concrete concepts	Identifies	2 units
Defined concept	Classifies	3 units
Rule	Demonstrates	4 units
Problem solving	Generates	5 units
Cognitive Strategy	Originates	6 units
Information	States	1 unit
Motor Skill	Executes	4 units
Attitude	Chooses	4 units

As with the number of CBEE Units assigned to the hierarchy of capabilities-based objectives, the number of CBEE Units required for one academic credit will be a topic for continuing research. The required number of attained capabilities per credit hour may differ among academic disciplines, though we propose that within an academic discipline a standard ratio should be set for equivalency. In initial application, described in further detail below, the 30 CBEE Units per credit hour ratio appears to be appropriate for graduate level courses in education.

Without defining the content or evaluating the quality of content, the CBEE Units model can provide institutions and accreditation bodies with a basic framework for determining the equivalency of academic courses and degrees, based on student achievement rather than time. The CBEE Units model does not propose to standardize objectives (curriculum) across programs and institutions, but rather to provide a standardized measure of educational equivalency that is not time-based (Watkins & Schlosser, 2000a, 2000b).

Putting Ideas into Practice

Since its conception, the CBEE Units approach to educational equivalency has been a topic of interest with the faculty of Instructional Technology and Distance Education (ITDE) graduate programs at Nova Southeastern University (NSU). The ITDE program offers graduate degrees focused on the useful applications of technology and distance education. Like many graduate programs that use a mixture of distance and conventional delivery systems, the ITDE program works to design courses where instructional tactics (e.g., classroom delivery, Internet chat) are determined by instructional objectives rather than administrative convenience. However, the program's faculty members are often frustrated when attempting to determine the appropriate scope (quantity and type of content) of courses to be "equivalent" to those offered in the conventional classroom.

The CBEE Units approach has been a useful tool for program faculty, as it provides an approximate benchmark for the scope of a one-, three-, or even five credit hour course. By making quantitative approximations (i.e., CBEE Units) for the qualitative description of what learners will achieve (i.e., objectives) the CBEE Units approach offers educators a "ballpark" standard for how many instructional objectives should be attained in a course that is worth a given number of academic credit hours.

In the initial application within the ITDE program, the CBEE Units approach was used during the redesign process of two courses on systems theory, analysis, and design. Objectives for each course (ITDE 8005 and ITDE 8006) were developed to correspond with Gagne's taxonomy of human capabilities. Through discussions with colleagues and adjunct faculty members, a core of instructional objectives were formulated and aligned with those of related courses.

Because objectives were written with the CBEE Units framework in mind, the course designers developed and assessed objectives to adhere to Gagne's taxonomy using appropriate action verbs (similarly, other objective taxonomies could be used). The course objectives were reviewed by colleagues who teach both the NSU courses as well as similar courses at other universities. These reviewers agreed that the scope of the objectives was appropriate for the corresponding academic credits.

Table 2: Application of CBEE Units

ITDE 8005 and 8006 Study Area				
Course Objectives: Given appropriate resources, learners will be able to…	**Type of Objective**	**CBEE Unit Value**	**Instructional**	**Assessment**
1. Accurately discriminate between the characteristics of an epistemology (realism, pragmatism, etc.) and a theory of learning (behaviorism, situated cognition, etc.).	Discrimination	1	• Required texts • Online readings • Email • Asynchronous chat • Audiobridge	• 8005 Assignment 1 • Online discussion • In-class performance
2. Accurately define the major characteristics of six theories of learning (behaviorism, situated cognition, etc.).	Concrete concept	2	• Required texts • Online readings • Email • Asynchronous chat • Audiobridge	• 8005 Assignment 1 • Online discussion • In-class performance
3. Accurately identify the epistemology(ies) that underlie six theories of learning.	Concrete concept	2	• Required texts • Online readings • Email • Asynchronous chat • Audiobridge	• 8005 Assignments 1 and 2 • Online discussion • In-class performance

4. Accurately generate descriptions of instructional strategies (including organizational, delivery, and management strategy characteristics) for each of six theories of learning.	Problem solving	5	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In class performance
5. Originate a valid and useful educational activity for each of six theories of learning.	Cognitive strategy	6	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In-class performance • 8005 Assignment 3 • Class presentation
6. Accurately generate an appropriate metaphor or analogy for each of six theories of learning.	Problem solving	5	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In-class performance
7. Originate a valid and useful personal educational philosophy based on two or more theories of learning.	Cognitive strategy	6	• Required texts • Online readings • Email • Asynchronous chat • Audiobridge	• 8005 Assignment 3 • Class presentation
8. Accurately define the components of a system.	Concrete concept	2	• Face-to-face instruction • Required texts • Online readings • Video conference	• 8006 Assignment 2 • Online discussion • In-class performance
9. Accurately identify an example of detail complexity.	Concrete concept	2	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In-class performance
10. Originate a valid and useful description of the potential influence chaos theory, complexity theory, and other "new science" approaches may have on system and systems theory.	Cognitive strategy	6	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In-class performance
11. Accurately identify an example of an open system.	Concrete concept	2	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In-class performance
12. Accurately identify an example of a closed system.	Concrete concept	2	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In class performance

13. Originate a valid and useful description of the relationships between system(s) theory and quality.	Cognitive strategy	6	• Face-to-face instruction • Required texts • Online readings • Video conference	• Online discussion • In class performance

Upon completing the objectives, available instructional technologies and assessments were identified for each objective (see Table 2). By aligning objectives with instructional technologies and assessments, the course designers could ensure that each objective was supported by the appropriate media as well as linked to formal or informal assessments.

Continuing the Dialogue

Offering a viable alternative to the Carnegie Unit, CBEE Units can provide institutions with an equivalency measure that allows time and location to vary while holding student capabilities relatively constant. In their initial application, the CBEE Units have provided a successful approach to equivalency within the ITDE graduate programs. However, many areas for continuing research remain. This article is an effort to continue a professional dialogue relative to useful alternatives to a standard of comparison that is losing relevance in higher education.

One of the issues requiring additional research is the potential weighting of higher- and lower-order objectives. Currently, capabilities-based objectives are assigned CBEE Unit values in single-digit increments (e.g., a rule focused objective has a value of 4 units and problem-solving focused objective has a value of 5 units). Although Gagne's taxonomy does not necessitate that objectives be considered hierarchically, a hierarchy is implied. The question may fairly be asked, "Should a cognitive strategy objective be assigned a value six times that of a discrimination objective?" In practice, this weighting has seemed about right, and feedback from peers has been supportive of these values. However, no research has been conducted to determine the appropriate relative weighting of objectives.

A related issue is that of the ratio of academic credits to capabilities-based objectives. We have suggested that one academic credit should equal 30 CBEE Units. As applied in ITDE 8005 and 8006, and in similar courses offered by others, initial observations have suggested that is ratio is appropriate.

The CBEE Units model, as presented, employs Gagne’s taxonomy of objectives. It does so because of its familiarity to and wide application by instructional designers. Further, Gagne provided objective verbs, which helped clarify the appropriate objectives for the human capabilities. However, alternative taxonomies of educational objectives (such as that proposed by Bloom) should be considered and compared. It is proposed that one could apply the same CBEE model to Bloom’s taxonomy and likely obtain the same results. This is an area worthy of further study.

Summary

Though the Carnegie Unit has provided higher education with a convenient standard of equivalency for nearly a century, the growing requirements for educational opportunities outside of the conventional classroom necessitate a reexamination of this time-based standard. With the rising use of technology in higher education, confirming the corresponding relationships across courses, certificates, and degrees is becoming a mounting challenge for educators and administrators alike. Contributing to the professional dialogue regarding alternatives to a time-based standard, this article has spotlighted the application of the CBEE Units approach within a single graduate program.

Based on the authors’ experiences, the application of the CBEE Units model offers a numerous benefits, among them:

1. The model offers a common measure of educational equivalency across departments, colleges, and universities. CBEE units are more appropriate, especially in a distance education environment, than are Carnegie Units.

2. The CBEE Units model eliminates the need for complex formulas that relate inappropriate variables, such as time. This is especially valuable when evaluating transfer credit.

3. Students, parents, employers are better able to judge courses, including the skills, capabilities, and knowledge students will gain from a course.

4. In its requirement of careful development of objectives, the CBEE Units model reinforces appropriate course design principles.

5. Similarly, the careful development of behavioral objectives may lead to a reduction in redundancy—both within and between courses.

And, while the CBEE Units approach calls for further research before broad utilization is feasible, for instructors and

instructional designers looking for guidance on ensuring the approximate equivalency of conventional and non-conventional courses and degrees, the CBEE Units approach offers a viable alternative. The continuing development of the CBEE Units model will require additional dialogue and research, but it may provide distance education with a starting place for meeting the requirements of an inevitably competitive future (Watkins &Schlosser, 2000b).

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