AC 2012-4030: ACCREDITATION RECIPROCITY: INTERCHANGEABILITY CHALLENGES BETWEEN BROADLY DEFINED AND NARROWLY DEFINED STUDENT ASSESSMENT METHODS

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Accreditation Reciprocity: Interchangeability Challenges between Broadly and Narrowly Defined Student Assessment Methods

As most accrediting bodies have moved to outcomes based assessment, many universities across the nation use various formats and processes to evaluate student work in demonstrating essential learning outcomes, such as the knowledge, skills and abilities that have been deemed vital to student's academic and social maturation. Technical knowledge, quantitative skills, core communication proficiencies, critical thinking abilities are just a few learning outcomes faculty members assess. Universities seek accreditation from regional and international accreditation agencies to earn national and international educational recognition as well as extensive funding contributions, such as grants (Lubinescu, 2001) [1]. Before approval is issued from the agencies to the universities, the accreditation agencies require applicants to provide supporting data for performance indicators such as educational and professional learning outcomes for college students as they progress through designated semester courses. The performance indicators can be generally or narrowly defined depending upon the accreditation agency.

Universities can seek accreditation approval that encompass assessment reports from the whole body of campus schools –such as institutional accreditation, which can be general and broad, or programmatic-discipline oriented, which can be more specific or narrow for reporting purposes. Oftentimes, universities solicit simultaneous accreditation approvals from varying combinations of both types, broad and narrow, accreditation agencies. The Higher Learning Commission - North Central Association (NCA) is an example of a regional, institutional accreditation agency whose higher learning accreditation outcome requirements can be more general and broad in nature and apply to a wide range of departments campus wide (North, 2011) [2]. In contrast, the Accreditation Board of Engineering Technology – Technology Accreditation Commission (TAC of ABET), an international organization, is an example of a program discipline-specific accreditation agency, whose focus is narrower for accreditation assessment criteria in Engineering and Technology programs encompassing disciplines such as Electrical Computer & Technology (ECET).

Both NCA and TAC of ABET accreditation requirements explicitly demand demonstration of quality education curricula, continuous academic improvements in development and student outcome assessments as critical components for universities and colleges desiring to acquire and maintain accreditation approval. Universities place high value on accreditation approval for a variety of purposes such as significant funding, national and international recognition and demonstrated student preparation to increase and maintain academic enrollment. However, an important characteristic of seeking accreditation –regardless of a broad or narrow approach- is the requirement to provide supporting student learning outcome progress reports. Faculty reports and student self-reports are the two most common formats for collecting the valuable student learning outcome assessments data in support of accreditation and re-accreditation approval. A

critical concern is the amount of faculty time and cost associated with the evaluation and reporting process for the student learning outcome information. Faculty time and cost are further increased when universities seek approval during same or overlapping timeframes for both campus wide and discipline-specific agencies to collect similar student outcome data. In other words, it is highly likely that faculty expends excessive time duplicating collected data to two different accreditation agencies.

This study examined Indiana University Purdue University-Indianapolis (IUPUI) that seeks accreditation approval from both regional –a.k.a. institutional- and discipline specific –a.k.a. specialized/programmatic- agencies. IUPUI seeks regional/institutional agency approval from the North Central Accreditation (NCA) (Indiana, 2007) [3]; IUPUI's School of Engineering & Technology seeks discipline specific/programmatic accreditation approval for their Engineering Technology department from the Accrediting Board of Engineering Technology –"EAC of ABET" & Technology Accreditation Commission -"TAC of ABET" (ABET-TAC, 2007) [4]. Similar to many universities around the country who seek multiple accreditation approvals, it is important to note that both accreditations are highly valued by IUPUI. It is important to also note, however, both types of agencies differ in their target membership. According to the Higher Learning Commission for NCA, "institutional accreditation speaks to the overall quality of the institutions without making judgments about specific programs" (North, 2011) [2]; whereas according to TAC of ABET, their goal is to accredit "post-secondary education programs in applied science, computing, engineering and technology" (ABET, 2010) [5].

The two sets of student learning outcome criteria are not identical. There are overlap and gaps in the two evaluative sets of criteria. However, both processes require substantial time and effort for faculty to track and mindfully evaluate student's work. The challenge, therefore, exists, first to maximize time and cost efficiencies across the various schools; second, to collect data that can be used interchangeably for the two accreditation programs when NCA measures broadly defined student learning outcomes and TAC of ABET measures more narrowly defined student learning outcomes (ABET, 2010) [5] for the IUPUI's School of Engineering and Technology.

Both the more broadly defined, NCA, and discipline specific, TAC of ABET programs require demonstration from the University's faculty that students are successfully meeting performance objectives. Both the programs require the faculty to regularly assess the performance objectives which can be in a self-report or faculty scored learning outcome assessment. Both agencies publish their performance indicator criteria to measure the learning outcomes. Both agencies ascribe certain key performance indicators that are accepted as a set of predetermined descriptions of knowledge, skills and abilities students are expected to have acquired to prepare them for the professional world. However, both agencies allow the petitioning university to decide on the methodologies and processes used to collect the designated supporting data. It is at this juncture in the process where faculty resources are oftentimes duplicated which can lead to excessive time and costs. Typically, both regional/institutional and ABET/programmatic

accreditation typically run on different year and period cycles for review. However, IUPUI collects its student assessment data for both agencies each semester; therefore, offset agency review periods do not influence the data collection and evaluation process.

The student assessment methodology IUPUI uses for accreditation purposes is a multi-method/multi-source approach. Using this approach, according to Elaine Cooney, Chairperson for the Department of Engineering Technology, "maximize[s] validity and reduce[s] bias of any one approach" (Cooney & Reid, 2004) [6]. Cooney and Reid continue, "even though all assessment options have advantages and disadvantages, the 'ideal' method… [should demonstrate] a balance between the program needs, validity, and affordability 'in time, effort and money'". The multi-method/multi-source approach uses guidelines from both the accreditation agencies to serve as the basis for creating evaluation rubrics to aid faculty is observing and assessing student learning outcomes

To meet the directives for the NCA accreditation program, IUPUI has identified six broadly defined critical areas for campus wide assessment purposes called *Principles of Undergraduate Learning* (PUL). Comparatively, IUPUI's Electrical & Computer Engineering Technology (ECET) program assesses students using eleven narrowly defined evaluative criteria, commonly referred to as the *a-k TAC of ABET criteria* (ABET-TAC, 2007)[4]. This paper addresses cross comparisons for two of the six PUL objectives, labeled: 1a, and 2; and two of the eleven TAC of ABET objectives, labeled c and g, as shown in Table 1. Both sets of objectives involve faculty ratings for student's non-technical skills, such as core oral and written communication skills, analytical, reporting and presentation skills. These two sets (PUL 1a, 2 & TAC of ABET c, g) were specifically selected for their descriptive similarities. Furthermore, these sets had been previously reviewed and cross-linked by the IUPUI's Engineering and Technology program faculty for verification of the sets comparative characteristics.

Table 1
Principals of Undergraduate Learning (PUL) and TAC of ABET Criteria Compared

	PUL		ABET-TAC
1a -	Ability to express ideas & facts to others thru a variety of formats: oral written, visual	g -	Ability to communicate effectively thru oral, written and graphical representation
2 -	Critical thinking: apply, analyze, evaluate, and create solutions for problem solving	c -	Ability to conduct, analyze, and interpret experiments; to apply processes for improvement

This paper compared data gathered from both data sets and examined how each of these objectives compared and contrasted in faculty ratings for students at undergraduate course levels in the Electrical & Computer Engineering Technology (ECET). Specifically, this study compared how students were rated by faculty using the two identified PUL ratings that are more generally defined with the two identified TAC of ABET ratings that are more narrowly defined in an attempt to ascertain how closely the ratings map to each other – indicating duplication of effort for faculty.

This research consisted of contrasting and comparing student assessments data sets faculty generated to help assess the following two PULs: 1a) ability to express ideas and facts through a variety of formats –oral, written, visual ; and 2) critical thinking. The two TAC of ABET criteria include: c) ability to conduct, analyze, and interpret experiments and to apply processes for improvement; g) ability to communicate effectively through oral, written and graphical representation. This study examined the relationship between the two data sets to ascertain if faculty could utilize the PUL data in support of the TAC of ABET data. We wanted to determine if the PUL evaluations would be *adequate substitution* for the TAC of ABET criteria to minimize student assessment duplication efforts for the two accreditation bodies –one broadly and one narrowly defined- to streamline faculty time and cost efficiencies campus wide.

Literature Review

Much of the literature points out the critical characteristics for the accreditation process as a whole: managing assessment programs, quality assurance monitoring to identify strengths and weaknesses of the program and insure continuous improvement (Hornbeck, 1999) [7]. In fact, Hornbeck emphasizes the importance of continuous improvement and quotes the National Commission on the Cost of Higher Education: "Accreditation seeks not only to judge and assure quality and integrity, but to promote improvement through continuous self-study and evaluation" (ABET, 2010) [7].

Assessing continuous improvement processes is time consuming and intensive. Lead faculty must evaluate and re-evaluate current programs for each accreditation board. This is done to ensure not only compliance with the approval requirements, but also evaluate student learning outcome assessment programs to monitor how effectively the students are meeting the course objectives to prepare for their professional careers beyond their academic experience (Stier, 2006, Duan,2009) [8,9].

The time consuming process, however, is extremely challenging for faculty, especially for Engineering Technology faculty. The PULs and TAC of ABET criteria prescribed in this study focus on evaluating student skills and abilities that are not technical in nature. These skills are more oral and written communication-based rather than technically oriented based. The ECET staff is well trained in "engineering and technology, but not necessarily experts in communication or leadership" (Cooney & Reid, 2004) [6]. Additional critical challenges include

the separate and different standards, guidelines and crucial need for multi-dimensional systems of accreditation and assessment documentation support (Lubinescu, 2001, Ward, 2002) [1,10].

Literature supports the value employers place on the knowledge, skills and abilities that are the crux of the educational objective foundation of higher education institutions and accreditation agencies (Koehn, 2005)[11]. According to Dr. Paul Stephanchick, "not meeting…industry hiring needs could result in reduced graduate placements. 'Schools of the future must encourage continuous learning and work in partnership with employing organizations to impart knowledge as a process'" (Stephanchick, 2003) [12].

There is no challenge to the value and importance accreditation approval means to universities; nor is there a challenge to the need of both general and discipline specific student evaluation criteria for most universities and colleges. Recent literature has even presented empirical support for the relationship between accreditation method and institutional performance on an empirical level directly tied to retention rates –another critical objective for higher learning institutions (Garcia, 2009)[13], but that exploration is outside the scope of this study.

However, there is limited research on examining faculty efficiencies –in terms of time- when performing possible duplication efforts for student learning outcome assessments. Therefore, the purpose of this paper is to examine and to cross compare dynamics of student assessments for core oral, written communication and critical thinking skills within the ECET discipline. The objective of the study was to ascertain supportive information between the two data sets (PUL & TAC of ABET) to demonstrate the need for streamlining evaluation processes campus wide in hopes of increasing faculty efficiencies and decreasing duplicate efforts. Therefore, we hypothesized that the PUL's 1a –core communication skills and TAC of ABET's g-ability to communicate effectively will measure similar results; and we hypothesized that the PUL's 2 – critical thinking skills and TAC of ABET's c – ability to conduct, analyze and interpret experiments will measure similar results.

Method

Participants

From IUPUI's Department of Engineering Technology, a total of 2225 undergraduate student's data sets were examined for this study. 2106 student data sets were gathered from previous Engineering Technology PUL reports and 119 student data sets were gathered from previous ECET TAC of ABET student assessment evaluations. PUL student records were extrapolated from a master data set for PUL 1a and PUL 2 data. ECET records were extrapolated for students who were evaluated on TAC of ABET criteria c and g. Spring 2010, Fall 2010 and Spring 2011 semester data sets were used for this study. All identifiers were removed from the data sets prior to this research; therefore, no demographic characteristics were available.

Materials

For the PUL evaluations, IUPUI Department of Engineering Technology faculty members completed a matrix worksheet which required the faculty to rate their students learning outcomes –PULs- on a 4 point Lickert scale: Not Effective, Somewhat Effective, Effective or Very Effective. Completed worksheets were submitted to the University's Office of Information Management (IMIR) that is responsible to secure all data on their server, remove identifiers and publish tabulated ratings to the reporting schools in an Excel Spreadsheet prior to releasing information for research.

For the TAC of ABET evaluations, the ECET faculty members completed a matrix worksheet that rated student's outcomes for the TAC of ABET criteria on a 4 point Lickert scale using *Below Average, Average, Above Average* or *Excellent* as qualifiers.

Since the PUL and TAC of ABET criteria Likert rating scales had different titles but similar categories comparatively, a template was created to group the data sets shown in Table 2.

Table 2
Category Mapping Scale Template

PUL Ratings		ABET-TAC Ratings
Very Effective	►	Excellent
Effective	►	Above Average
Somewhat Effective	►	Average
Not Effective	►	Below Average

Procedure

First, the data set for the PUL records and the data set for the ECET TAC of ABET records were obtained from Elaine Cooney, Chairperson for the Department of Engineering Technology at IUPUI. Second, a pivot table in Excel was created linking the master PUL file and extrapolating the student's criteria for the PUL1a & 2 criteria. The data records for the TAC of ABET data set for students assessed on TAC of ABET c & g were manually entered into a separate Excel spreadsheet. Third, a master Excel spreadsheet was created for the PUL data set (student records containing PUL measures of 1a & 2) and the student records for the TAC of ABET (criteria c & g). Fourth, student grouped counts per PUL/TAC of ABET records were combined and grouped into categories shown in Table 3. Finally, two chi-square goodness of fit tests were manually calculated to analyze the data and compare the stated hypotheses: the null hypothesis is there are no differences in PUL 1a criteria distributions (observed population) and TAC of ABET g criteria distributions (expected population). We explored whether PUL 1a ratings could

adequately be used as substitutions for the known population of TAC of ABET g and if PUL 2 ratings could adequately be used as rating substitutions for the TAC of ABET c ratings.

These calculations were then compared with a standard on-line chi-square test goodness of fit automatic calculator for accuracy comparisons. Chi-square goodness of fit tests are widely used in assessing statistical significance for nominal data. This test type was selected since each observation was independent of each and every other observation using nominal data, meeting a critical condition of the test's reliability. Upon completing two chi-square goodness of fits tests, analysis for significance was completed.

The focus for this study was to examine two types of student assessment record sets from two independent university accreditation formats, one with broadly defined and one with narrowly defined criteria. We identified and examined two broadly defined accreditation criteria, as our observed population, for use towards the IUPUI's reaccreditation efforts with North Central Association: PUL 1a – core communication skills and PUL 2 – critical thinking ability assessment. We also identified and examined two narrowly defined accreditation criteria, for our expected population distribution, for use towards IUPUI's reaccreditation efforts from Accreditation Board of Engineering Technology -Technology Accreditation Commission.

Results

Two chi-square goodness of fit tests were run. Engineering Technology student assessment records from 119 ECET discipline-specific students represented the TAC of ABET expected population. Student assessment records from 2106 Engineering Technology students (not including the 119 ECET students in the expected population set) represented the observed population. The breakdowns for student counts used are shown in Table 3.

Table 3
PUL & ABET-TAC Analysis Chi-square Goodness of Fit

	Not Effective or Below Average	Somewhat Effective or Average	Effective or Above Average	Very Effective or Excellent		
Test 1						
PUL 1a	52	106	207	348	713	Observed
ABET-TAC g	3%	19%	72%	6%		Expected Population
Test 2						
PUL 2	116	275	501	501	1393	Observed
ABET-TAC c	9.09%	9.09%	45.45%	36.36%		Expected Population

A chi-square goodness of fit test was calculated comparing the distribution of PUL 1a to TAC of ABET g ratings. A significant deviation from the TAC of ABET g values was found ($\chi^2(3)= 2645$, $p<.05$). The PUL 1a distribution differs from the hypothesized ABET-TAC g distribution.

A chi-square goodness of fit test was calculated comparing the distribution of PUL 2 to ABET-TAC c ratings. A significant deviation from the TAC of ABET c values was found ($\chi^2(3)= 202$, $p<.05$). The PUL 2 distribution differs from the hypothesized TAC of ABET c distribution.

Discussion

The results from both the chi-square goodness of fit tests mean that the PUL data vary from the expected TAC of ABET distribution. In terms of our original research questions, this means that given the current student assessment rating process, it appears that the PUL data are not a good substitute for the TAC of ABET data. In other words, using the selected data set, our results did not indicate that PUL evaluations could be an *adequate substitution* for the TAC of ABET evaluations.

Being able to demonstrate accreditation reciprocity measurements for the broadly defined PUL student assessment criteria and the more narrowly defined TAC of ABET student assessment criteria of this study would have resounding benefits throughout the Engineering Technology programs. However, this study was not able to provide sufficient validation for substituting the different student assessment measurements at this time with this given population set. The two comparisons (PUL 1a and TAC of ABET g; PUL 2 and TAC of ABET c) did not map closely together with the two data sets in comparing expected and observed population samples.

One possibility for the results could be differences in how faculty members assess students when interpreting and rating the two criteria. For example, some faculty may not map a student using the definition of PUL 1a –Critical thinking the same as TAC of ABET g – Ability to apply processes for improvement; as shown in Table 1. Another possibility could be that assessments were made at different times during the semester for students and the outcomes at each interval differed. Another factor could be that this study had much more data available in the PUL data set than the TAC of ABET data set from faculty. Furthermore, there are multiple PUL criteria mapped to TAC of ABET criteria. For example, TAC of ABET criteria "e" measures a student's "ability to function effectively as a member or leader on a technical team" (ABET, 2007)[4], but both PUL's 1 and 5 "core communication" and "understanding society and culture", respectively, are currently mapped together which make clear comparisons challenging. However, for purposes of this study, criteria for PUL and TAC of ABET were simplified for comparisons as shown in Table 1.

Effectively, using this study's data sets, we can say that the criteria ratings are not mapping together. However, we cannot necessarily determine if faculty members are measuring and categorizing the same criteria in the same way. Some possibilities for these findings could be that faculty are indeed measuring the same evaluation criteria, but may be rating students

differently given the two different Likert scale categories (i.e. TAC of ABET "Excellent" rating compared to PUL "Very Effective" rating). Other possibilities could include a situation when we may not have had sufficient access to other data sets in other ECET courses to measure and compare results.

Limitations to this study include the overlap and gaps present between the two describing characteristics of the assessment criteria. For instance, TAC of ABET's description is narrowly focused on experiments and evaluations within the Engineering Technology programs, whereas, the PUL's focus is more generic and does not necessary have an Engineering Technology application. Therefore, faculty may not categorize student outcomes within the same framework as used in this study. Also, only three cycles of data has been collected to date. The accreditation time line extends for many years and therefore, more time may be needed for analysis purposes. Given the level of interpretive latitude from both accreditation agencies in creating IUPUI's assessment rubrics, it's possible the results from this study may not be generalizable to other accreditation programs.

Conclusions

True time saving costs for faculty can be further evaluated in consideration of being able to map the broadly defined student assessment criteria with the more narrowly defined student assessment criteria. Future considerations would include exploring closer why the data sets did not map together; how faculty across campus and across programs define the categories (i.e. "Excellent" versus "Very Effective) and record student assessments. Future considerations could also include investigating the overlaps and gaps in both the accreditation criteria and explore possible pilot tests to seek alternative ways to map and measure the multiple groups of assessment closer together in an effort to reduce faculty duplication time, energy and costs.

"Simply put, accreditation is value. Reaching into our public, private, and professional lives, accreditation is proof that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions" ABET, 2011)[14]. Like education and accreditation, our faculty's time and energy are valuable, too. Finding ways to enhance, streamline and increase efficiencies in processes such as combining assessment evaluations are just some of many avenues worthwhile to explore.

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