Application of Matrix Outcome Mapping to Constructively Align Program Outcomes and Course Outcomes in Higher Education

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Abstract

Establishing a link between Course Learning Outcomes (LOs) and Program Outcomes (POs) while assessing the course contents and delivery are among the most challenging issues in Higher Education. In the present study two forms were generated based on specific Course Learning Outcomes identified in the syllabus at the beginning of the teaching term: a Student outcome evaluation form and a Faculty outcome evaluation form. The objective is was to assess if the outcomes specified in the syllabus are being delivered and are being delivered throughout the term. At the end of the semester, a student survey was given to students to evaluate the course outcomes. In addition, the faculty evaluated the course outcomes. A matrix was developed mapping the results of the student, the faculty and each assessment contributing to the specified outcome, all are on a similar scale. A mapped matrix was then generated based on the results. The results from the mapped Matrix pinpoint which assignment contributed to the specified outcome, and show the gaps between the student evaluation and faculty evaluation. All data and results are set within a dashboard. The Dashboard is used as a tool to help see where improvements are needed, whether an assessment has contributed to the LOs or not and how much has contributed to the PO, thus constructively aligning POs and LOs with continuous improvement as a focus.

Keywords: course outcomes, program outcomes, continuous improvement, matrix outcome mapping

1. Introduction

This paper looks at one of the most challenging issue in Higher Education, assessing the course contents and delivery. Several components are evaluated in delivering a course: the instructor's subject knowledge, the instructor's communications skills, the environment where the teaching is taking place, the organization of the course, the delivery of the course and the contents of the course. This paper concentrates on assessing the contents of the course. Two evaluation forms are generated based on the outcomes identified in the syllabus at the beginning of the teaching term: student outcome evaluation form and faculty outcome evaluation form. The objective is to assess if the outcomes specified in the syllabus are being delivered through a semester term. This study is part of a Six Sigma Process Design on course content delivery, or continuous improvement in course delivery. A model providing metrics to the constructive alignment such in the Briggs model (2003).

This paper concentrates on the relative contribution of Learning Outcomes (LOs) and Program Outcomes (POs) to an evaluation process necessary to continuously improve course content and delivery, resulting in greater course performance. Several characteristics impact the outcomes of the course such as communications, knowledge of the subject matter, room design and layout, technical tools used, etc…

The design of the course and the syllabus are key components for the pre-delivery of the course. From these two aspects, course outcomes are derived and spelled out for a specific course. The objective of this paper is to focus on a method to continuously improve on achieving the course outcomes using algorithmic and a heuristic approach to provide a performance process for the courses after each semester and for other programs within a Higher Education Institution. In this model, the processes identify where the weaknesses are, where Learning Outcomes and/or Program Outcomes are not achieved and a concentration is needed in order to achieve or get closer to the Key Performance Indicators (KPIs).

The idea in this model is to check whether the Course assessments (CAs) have any impact on LOs and on POs, and then make decisions about which courses have more impact on the POs. The information of the CA is gathered from the student outcomes evaluation, the faculty outcome evaluation, and the predicted KPIs from the institution. A GAP analysis then is performed to check whether the KPI's have been met or not.

In the course syllabus, the course outcomes are evaluated by the student and faculty where an assessment table is generated matching the course outcomes. A Matrix in a form of dashboard is then developed having all criteria in one table. The Criteria for course outcome are aligned with the following:

1- The higher education authority of the country criteria
2- University Criteria
3- School Academic Criteria

Once a course is delivered for one semester, a benchmark or base line for each specific course is generated given that it met all criteria. The process is as follows: first the outcomes are identified in the syllabus, at the end of the semester, a student survey is given to students to evaluate the course outcomes on a Likert Scale. Then the faculty evaluates the course outcomes, and eventually a matrix is developed mapping the results of the student, the faculty and each assignment contributing to the specified outcome, all on a similar scale (Figure 1).
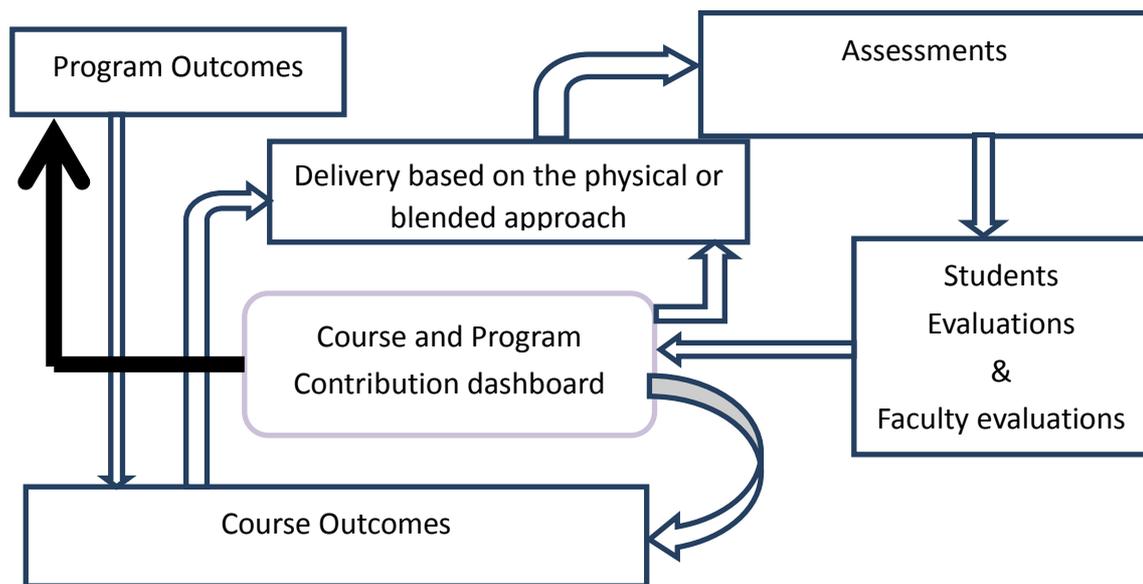

Figure 1. Diagram course and program matrix

2. Literature Review

Briggs (2003) in his seminal work on constructive alignment provided a framework for showing the important of course design, assessment tasks and learning activities to achieve course and program outcomes. While this is a useful conceptual model, another approach was shown by Hafeez and Mazouz (2011) to use a continuous improvement process to look at POs and LOs to achieve program goals. The authors suggested the use of a Quality Function Deployment (QFD) Matrix as shown in Figure 2 and 3. They translated this information into the educational framework and found that QFD is a highly innovative and effective way of ensuring that Learning Outcomes are achieved and identified in the areas where improvement strategies and interventions are to be administered. A typical scenario of this process is as follows:

- Identify the program goals,
- Identify the program outcomes;
- Subjectively derive the program learning outcomes from the course outcomes.

From ten learning outcomes in an Undergraduate Bachelor of Arts in Business and Quality Management Program, a matching process against each course taught was generated. A panel subjectively ranked program outcomes against each course offered. Using the QFD traditions, the scale adopted was 0, 1, 3, and 9, where 0 refers to a particular course making no contribution to the program outcome. Accordingly, 1 means some contribution, 3 means moderate contribution and 9 – substantial contribution.

Subsequently, a normalized column was generated based on subjective scores. As expected, the courses that scored higher in the normalized column were the core courses that should ensure a substantial integration of specialist and core courses with the objectives of the program. The courses in the General Education requirement area, such as Introduction to Management, Introduction to Psychology, Microeconomics and Introduction to Human Resource Management, scored low against program outcomes, on the other hand, these courses scored higher against the University's Institutional Learning Outcomes.

Srikanthan and Dalrymple (2007) Addressed a holistic model for quality in higher education. The authors stated two distinct types of processes: (1) the services to the student body: in academic (e.g., enrolment, library), or administrative (e.g., cafeterias, recreation) areas; and (2) the teaching and learning (both education and research) activities. In service areas, the application of a model for quality management should be appropriate, as in banking or travel, where the processes are tangible; the products are of a narrow range; and the processes are customer driven. Whereas, it is difficult to apply quality management models to teaching and learning, because the quality management models are measurement focussed. Product Control is crucial for quality management: teaching in higher education is too varied in its products, site delivered, delivery modes, processes and personnel to be controlled. Customer focus is the key tenet of quality management models: in higher education the identification of the customers is a critical problem.

Hatzakis1, Lycett and Serrano (2006) concentrated on issues of coherence' in Higher Education- curricula. Curriculum coherence can be jeopardized by poor curriculum design, misalignment between module content and/or misalignment between module or course aims can cause serious coherence issues over time. Mainly misalignment of this type is intensified by the traditional processes of curriculum design and redesign. The misalignment is due to highly abstract syllabus and course specifications. No clear communication between curriculum designers and course offerings. Hatzakis1, Lycett and Serrano tackle the issue on how to improve the curriculum coherence. They developed a programme management framework as a means of (a) 'humanizing' the abstract aims and goals of curricula schemes and (b) managing the delivery and evolution of curricula in relation to the stakeholders in the process of delivery.

Munteanu et al (2011), investigated differences in student satisfaction across different programs of the same business college. They also looked at identifying the dimensions underlying overall perceived quality. Their aim was to investigate the differences in perceived quality among programs and factors determining those differences. The authors concluded that in comparison with similar studies developed in western universities, the list of critical incidents contains noticeable differences. And it was found that students with different academic performances are concerned with different critical incidents. In overall, satisfaction with educational experience was found among different lines of specialisation. One major concern pointed out by the authors was not considering student motivation as an important influential variable on both academic performance and overall satisfaction. From a practical aspect, organisations, including higher education are increasingly recognising that today's customers have many alternatives to chose from, that they may more readily change providers if they are not content, and that satisfaction largely depends on the quality of service provided.

Chen (2006) used the balanced scorecard as a performance evaluation in higher education management. Five strategic themes were constructed, financial structure, customer expectations, learning environment, organization learning and management, and high quality staff. Strategic target themes were identified. The study was based on a case study looking at carrying the mission and vision in higher education institution. The rapid growth of the educational system and becoming more competitive, the international competition has become more intense, which lead to unbalance in the education system and a reduction in the educational quality. Tools such as Balanced Scorecard and Six Sigma can be used to improve the quality in the education system. The case study was done for a Taiwanese Institution and developed a BSC framework for the Higher Education institution. It did confirm that it is a useful tool to increase the quality of education in Higher Institutions.

Nusche (2008) provided an international perspective on current practices in standardized learning outcomes assessment in higher education. She explains the scope and limitations of the work, whereas a proposal of a typology of different types of higher education learning outcomes, and comments on the advantages and drawbacks of using different types of outcomes as indicators of learning quality was identified. Then, she described the ways in which different types of outcomes have been assessed across countries.

Based on illustrative evidence collected for 18 assessment instruments, this study examined conceptual, organizational and methodological aspects of existing assessments. It proposed a typology of higher education learning outcomes and reviewed the ways in which these have been assessed across countries. Examples were drawn from Australia, Brazil, Mexico, the United Kingdom and the United States.

Amin R. and Amin N. (2003) in their article, dealt with the efficacy of a model benchmarking in learning assessment in higher education. The authors demonstrated how benchmarking leads to continuous curriculum

improvements of instructional process. By developing competency expectations, the model led to several data collection analyses towards benchmarking learning outcomes. It did lead to continuous improvement of institutional process and the curriculum. The model was of a practical nature, but it has not been replicated. The authors foresee if the model is replicated, it will develop a benchmarking of learning outcomes in higher education.

Weinberg et al (2009), developed an original measure of learning in higher education, based on grades in subsequent courses. This led to showing that student evaluations are positively related to current grades but unrelated to learning once grades are controlled. There is evidence that the weak relationship between learning and student evaluations arise, because students are not aware of how they have learned in the course.

Straythorn et al., (2007) indicate that developing credible and manageable assessments is a growing concern. The resources to aid busy administrators and faculty in implanting assessment of their work day-to-day routine are growing. The article builds on the work that the Council for the Advancements of Standards in Higher Education (CAS) began in 1979. It provides Frameworks for Assessing Learning and Developments Outcomes throughout the years.

Hakan Wiklund et al., (2003) stressed the concern of assessments in Nordic European countries, and identifies that, for instance, the Swedish assessment system should have as corner-stone the specific prerequisites for each university and subject, as for example business administration and their strategy. The article emphasised the aspect of innovation and continuous improvement in higher education where three major components are the basis for the work: Values, Tools and Techniques, a replica of a TQM approach. It describes two forms of quality assessments in Sweden, the first pioneered in 1995. The process had similarities with most of the well known Quality Awards. The second form of quality assessment, started in 2001 and provided a new comprehensive system for quality assessment called: National Evaluation of Subjects and Programmes". The focus changed from "how" things were done to "what" was done and perceived. Three dimensional assessment was used: the precondition of education, how the education is conducted and finally results of education.

Ceulmans et al., (2011) showed that attention Sustainable Development is growing, even in higher education. The importance of sustainable development integration in higher education, both on strategic and operational level, is often stressed, but the actual measurements of this integration are less frequent. In the article, the authors identified 33 professionally and academically oriented programs of applied economics in a total of 22 Flemish Higher Education institutions. A large scale assessment was set up to assess Sustainable Development integration. The integration in applied economics programs is crucial for society, such as business students who are our future managers. The interrelations between different Sustainable Development integration strategies and the barriers to them were studied in the research, leading to a new concept, where two different dimensions of Sustainable Development integration are combined. From the research it was concluded that a Sustainable Development integration approach that combines horizontal and vertical integration with bottom-up and top-down seems to be the most beneficial for sustained SD integration.

Table 1. An example of subjective assessment of course outcomes with the help of program objectives

	O1 – Be able to apply a wide range of business and quality concepts in organizations representing different industry sectors.	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7	Outcome 8	Outcome 9	Outcome 10	Subjective Importance of HOW (the course)	Weighted Importance (*# of C/H)	Normalized Importance (%)
Operations Management	3	3	9	9	9	9	9	9	3	3	66	198	8
Business Strategies	3	3	9	9	9	9	9	9	9	9	78	234	9.4
Overall	70	38	162	108	118	108	64	70	86	100	830	2490	100
Normalized Results	8.4	4.6	19.5	13	14.2	13	7.7	8.4	10.4	12	111.3	214.2	423.9

Table 2. An example of subjective assessment of course outcomes with the help of program objectives

	O1 – Be able to apply a wide range of business and quality concepts in organizations representing different industry sectors.	O2 – Appreciate Quality Gurus contribution in the development of TQM thinking and its impact.	O3 – Be equipped with technical, interpersonal skills and expertise to assist them in their managerial positions.	O4 – Gain a holistic, comprehensive understanding of factors which drive organizational excellence through an interdisciplinary organizational context.	O5 – Be able to initiate and drive quality and excellence initiatives.	O6 - Be able to perform as change agents, trouble shooters and advisors in the areas of business and quality management.	O7– Gain awareness on different types of organizational structures and in particular Process Centered Organizations (PCOs).	O8 – Examine the role of systems such as ERP, ISO 9001:2000 in support of value-based work.	O9 – Actively participate in developing the organization's mission, strategic plan goals, and policies.	O10 – Be able to lead organization's human resources and manage financial.	Subjective Importance of HOW (the course)	Weighted Importance (*# of C/H)	Normalized Importance (%)
Operations Management	3	3	9	9	9	9	9	9	3	3	66	198	8
Business Strategies	3	3	9	9	9	9	9	9	9	9	78	234	9.4
Overall	70	38	162	108	118	108	64	70	86	100	830	2490	100
Normalized Results	8.4	4.6	19.5	13	14.2	13	7.7	8.4	10.4	12	111.3	214.2	423.9

3. Methodology and Approach

Six Sigma is a business management strategy widely used in many sectors of industry, and is maturing within the academic environment. Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability within a process. Quality management tools and techniques are used including statistical methods, and create a special infrastructure. For instance a Six Sigma project within an organization follows a defined sequence of steps and has quantified targets.

Just as in a Six Sigma Process characteristics must be identified first. In this case, each characteristic was identified as an outcome (which is what the student/customer is expected to receive at the end of the semester). For instance, this study uses the course Business Statistics, and here the outcomes were:

1. The student will have a good grasp of probability density and distribution functions.

2. The student will understand central tendency and variability.

3. The student will be able to perform hypothesis testing.

The second phase of a Six Sigma Process Design is the design of the course in terms of delivery and assignments. The delivery process is twofold: first it is based on the knowledge and the communications skills of the instructor, second it is based on the assignment and engagement of the student during the semester.

These two facets of the process have to be assessed through students' surveys, faculty evaluations and matrix compilation. From the syllabus, we can identify the different assignments. Figure 4. depicts this aspect, extract from the syllabus. Then the assessments are identified, as for instance homework, exams, projects, case studies, etc. In this particular course, there were eight homework assignments identified in Figure 2. And two exams were given and a final. Another assessment was given to the student is data analysis performed as a case study. A set of data was given, and the students had to develop five graphs from the set of data and make comments on each graph. What follows are the surveys forms, where the student and the faculty will rate the outcomes specified for the course. This is illustrated in Table 3 and 4.

Table 3. Common course syllabus

Common Course Syllabus	Homework Assignments		Assessments course grading
Business Statistics	1-	Homework 1: Frequency Distribution	Attendance….10%
Syllabus	2-	Homework 2: Descriptive Statistics	Homework…..30%
Catalogue Data: 3 CREDITS	3-	Homework 3: Software Applications: Excel	Case Study….20%
Goals: Student should be able to manipulate data and have the ability to translate data to information. Have knowledge of data analysis and be ready for subsequent classes such as experimental design, design of experiments, design for manufacturing, and higher level of engineering courses.	4-	Homework 4: Mean and Standard of Deviation	Exam 1………10% Exam 2………10% Final Exam….20%
	5-	Homework 5: Hypothesis Testing Part 1	
Prerequisites by Topics:	6-	Homework 6: Hypothesis Testing Part 2	
1. Junior Standing			
Topics:	7-	Homework 7: Nonparametric Statistics	
1. **Treatment of data: Pareto Diagrams; Frequency distributions; Graphs; Descriptive measures; Software applications; Excel;**		Homework 8: ANOVA	
2. Inferences: Inference about Means; Inference about variances; Inference about Proportions;			
3. Nonparametric Tests: Goodness of fit tests in Business Applications, Sign test; Rank-Sum test; Tests of randomness; Kolmogorov-Smirnov and Anderson-Darling tests.			
4. Curve Fitting: Least Square; Inference based on the Least Squares estimators; Linear Regression and non linear regression and Multiple Regressions; Model development and Applications in Business.			

5.   Analysis of Variance: Process Optimization,

Course Outcome:

1.   The student will be able to have a good grasp data analysis and perform subsequent tests.

2.   The student will be able to perform process optimization.

3.   The student will be able to perform inference on different type of business problems

4.   The student will be able to data analysis and derive models in using linear and non-linear regression in different business applications.

Design Content:

This course has no formal design or projects.

Table 4. Student survey outcomes

Student Survey Outcomes	Faculty Survey Form
School/College...................................	*Faculty Course Comments Form*
Department …………………………..	*Course Number and Title:*
Student Survey of Course Outcomes	
Course Number and Title:	*Semester Taught:*
Semester Taught:	*Instructor:*
Instructor:	*Prerequisites:*
Please use this form to rate your personal feelings of achievement of the published outcomes for the course as listed below. The following 0 to 5 rating scale should be used in assessing your achievement of the outcomes. This information will be presented for review to the committee at the end of each semester. The committee will evaluate performance of the specified outcomes by the students and make recommendations for changes as appropriate.	*This form is to be used at the end of the semester to make comments about your experiences with the students in your class. Please make any comments that you feel are appropriate about positive or negative observations.*
	• Do you feel that the students had the necessary background from the prerequisite courses that they needed? Was remedial work necessary?
5 - Complete understanding of the technical content of the outcome or the specified skills and a confidence in applying the techniques to Business problems.	*• Do you feel that they progressed throughout the semester as you planned?*
4 - Good understanding of the technical content of the outcome or the specified skills and an ability to apply the techniques to business problems.	*• Please use the following 0 to 3 scale to rate your coverage of topics/skills of each outcome.*
3 - Adequate understanding of the technical content of the outcome or the specified skills and some ability to apply the techniques to business problems.	*3 – Ample time to cover the topic/technical content of the outcome or the specified skills.*
2 - Marginal understanding of the technical content of the outcome or the specified skills and some difficulty in applying the techniques to business problems.	*2 – Adequate time to cover the topic/technical content of the outcome or the specified skills.*
1 - No understanding of the technical content of the outcome or the specified skills.	*1 – Limited time to cover the topic/technical content of the outcome or the specified skills.*
0 - Did not cover the information specified in the outcome in the class.	*0 – Did not cover the topic/technical content of the outcome or the specified skills.*
	Outcome 1:_____ Outcome 2:_____Outcome 3:_____Outcome 4:_____
	Please rate the overall class achievement of the course outcomes for your course using the following 0 to 5 scale.
Outcome 1: The student will understand the concept of reengineering, benchmarking, process optimization in a global	*5 – Students exhibited complete understanding of the technical content of the outcome or the specified skills and showed confidence in*

environment. _____

Outcome 2: The student will understand the concept and practical techniques of global organization, cross-cultural challenges, motivation and leadership _____

Outcome 3: The student will understand the concepts of organization knowledge, knowledge management and technology transfer concepts. _____

Outcome 4: The student will understand basic operations management methods, and be able to use software to accomplish optimization, planning/scheduling, and statistical analysis. _____

applying the techniques or skills.

4 – Students exhibited considerable understanding of the technical content of the outcome or the specified skills and showed an ability to apply the techniques or skills with few mistakes.

3 – Students exhibited a partial understanding of the technical content of the outcome or the specified skills but showed limited ability to apply the techniques or skills, often committing minor mistakes.

2 – Students exhibited little understanding of the technical content of the outcome or the specified skills and had difficulty in applying the techniques or skills to engineering problems.

1 – Students exhibited no understanding of the technical content of the outcome or the specified skills and were unable to apply them to engineering problems.

0 - Did not cover the information specified in the outcome in the class.

Outcome 1:_____Outcome 2: _____Outcome 3:_____Outcome 4: _____

This information will be presented for review to the Department committee at the end of each semester.

The results were then tallied from the student surveys and the faculty surveys for each course. The next step was to develop the GAP analysis matrix. Two GAP matrix tables were then generated. The first one Table 5 depicts the GAP matrix related to Student survey learning outcomes, and Table 6, the second matrix, depicts the results of the faculty survey learning outcomes. The next Table 7, the GAP matrix, looked at the Student/Faculty differences in perceiving to the learning outcomes based on the course assessments. The main purpose in this part was to check whether there was a difference in assessment between the assessor which is in this case was the faculty and the person taking the assessment which is in this case was the student.

From scale 1 to 5 the student evaluated the grade for a specific assessment to the learning outcome. For instance, the evaluation from the student for assessment 1 to learning outcome 1 (LO1) is 3 while the evaluation by the faculty for assessment 1 to learning outcome 1 (LO1) is 4. Then all evaluations of assessments from the student survey and the faculty survey were tallied to eventually come up with a quantifiable difference between both evaluations. These data generated the GAP matrix in Table 8.

Table 5. Results of student survey learning outcomes

LO2	LO3	LO4	Student Survey Average
4	3	5	3.6
4	4	4	3.8
3.4	3.3	3.2	3.6

Table 6. Results of faculty survey learning outcomes

	LO1	LO2	LO3	LO4	Faculty Survey Average
Assessment 1	4	5	5	4	4.6
Assessment 2	5	5	4	4	4.4
Average	4.2	4.6	4.5	3.8	4.3

The following GAP matrix Table 7 is tallied by the academic committee, where each faculty has provided inputs related to the course taught by him or her.

Table 7. Learning outcomes GAP table

	Student Survey Total	**Faculty Survey Total**	**GAP (Delta)**
Assessment 1	3.6	4.6	1.0
Assessment 2	3.8	4.4	0.6

Table 8. Program outcomes GAP table

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**Average**	**GAP (Delta= 5 - result)**
Course 1	4	3	4	3	3	3.4	1.6
Course 2	3	4	3	3	5	3.6	1.4

The KPI for each LO is identified as 5. Once results of the first cohort were generated, a Benchmark was set, which was the threshold indicator acting as a gage for the next semester. The following Table 9 compiled all the results from the student surveys and the faculty survey for a specific course, in this case Business Statistics. Then three pertinent information items were generated:

1) Relative contribution of each assessment to each Learning Outcome
2) Contribution of each Learning Outcome to each Program Outcome
3) Relative contribution of each Learning Outcome to Program Outcomes

Table 9. Dashboard: Example for higher education

	Assessment	Student Survey	Faculty Survey	Delta (Faculty-student)	Weight	Converted (Delta * weight)	Overall	Relative Contribution of Assessment to LO	Contribution of LO to PO1	Contribution of LO to PO2	Contribution of LO to PO3	Contribution of LO to PO4	Contribution of LO to PO5	Contribution of assessment to PO	Weight	Normalized Delta	Overall Contribution of LO to POs	Relative Contribution of LO to PO
LO1									30	30	0	0	40					
	HW	4	5	1	30	4.57	137.14	**29.54**	886.15	886.15	0.00	0.00	1181.54	100.43	30	0.26	82.12	**0.35**
	Exams	3	4	1	40	4.43	177.14	**38.15**	1144.62	1144.62	0.00	0.00	1526.15	129.72	40	0.45		
	Case study	5	5	0	30	5.00	150.00	**32.31**	969.23	969.23	0.00	0.00	1292.31	109.85	30	0.29		
	LO1 contribution to PO								**10.10**	**10.10**	**0.00**	**0.00**	**13.47**					
LO2									10	40	30	10	20					
	HW	3	4	1	30	4.70	141.00	**30.26**	302.58	1210.30	907.73	302.58	605.15	93.80	30	0.27	77.19	**0.33**
	Exams	3	2	1	40	4.60	184.00	**39.48**	394.85	1579.40	1184.55	394.85	789.70	122.40	40	0.47		
	Case study	4	5	1	30	4.70	141.00	**30.26**	302.58	1210.30	907.73	302.58	605.15	93.80	30	0.27		
	LO2 contribution to PO								**3.33**	**13.33**	**10.00**	**3.33**	**6.67**					
LO3									40	10	30	20	0					
	HW	4	4	0	30	5.00	150.00	**32.31**	1292.31	323.08	969.23	646.15	0.00	48.46	30	0.29	37.52	**0.16**
	Exams	4	3	1	40	4.43	177.14	**38.15**	1526.15	381.54	1144.62	763.08	0.00	57.23	40	0.45		
	Case study	5	4	1	30	4.57	137.14	**29.54**	1181.54	295.38	886.15	590.77	0.00	44.31	30	0.26		
	LO3 contribution to PO								**13.33**	**3.33**	**10.00**	**6.67**	**0.00**					
LO4									0	0	30	30	40					

HW	4	4	0	30	5.00	150.00	**32.61**	0.00	0.00	978.26	978.26	1304.35	52.17	30	0.29	38.01	**0.16**
Exams	3	4	1	40	4.00	160.00	**34.78**	0.00	0.00	1043.48	1043.48	1391.30	55.65	40	0.42		
Case study	4	4	0	30	5.00	150.00	**32.61**	0.00	0.00	978.26	978.26	1304.35	52.17	30	0.29		
							LO4 contribution to PO	**0.00**	**0.00**	**6.74**	**6.74**	**8.99**					

The relative contribution of each assessment to each Learning Outcome was generated from a compilation based on the results from the GAP matrix. The results were derived from the student surveys and the faculty survey, then a normalized weight was calculated. For instance, for the course in question, Business Statistics, it was noted that for LO1, exams contribute the most with 38.15 % compared to case studies with 32.31% and homework with 29.54%. More emphasis then should be made on exams for LO1. As is shown in Figure 11, exams contribute the most to all LO's. Similar findings were noticed for the LO2, LO3 and LO4, where exams contributed the most with 39.48 %, 38.15 %, and 34.78 % respectively. In the second position where case studies with 32.31 % for LO1, 30.26% for LO2, 29.54% for LO3, and 32.61 for LO4. Finally, homework contributed the least compared to the other assessments. Given these results, it is suggested that a closer look be given to those assessments in the next two or three upcoming semesters, then action taken to review the type of assessments and possible reasons for these results.

4. Discussion and Recommendations

The contribution of each Learning Outcome to each Program Outcome is translated as expected from the course syllabus, and Figure 11 shows where LO1 contributes the most to PO5 with 13.47 compared to the contribution of PO1 and PO2 of 10 each. The contribution to PO3 and PO4 is zero"0". LO2 contributes the most to PO2 with 13.33, and 10.00 to PO4. The contributions to PO1, PO4 and PO5 are low as 3.33, 3.33 and 6.67 respectively confirming the statements in the syllabus. The contribution of the Learning Outcome 3 to each Program Outcome is 13.33 to PO1, 3.33 to PO2, 10.00 to PO3, 6.67 to PO4 and 0.00 to PO5. As the findings confirm, there is more contribution to PO1 from LO1. The contribution of the Learning Outcome 4 to the Program Outcomes is mostly emphasised by the contribution 8.99 to PO5and to PO3 and PO5 of 6, 74 each compared to the contribution of PO1 and PO2 of "0' zero.

The relative contribution of each Learning Outcome to the overall Program Outcomes is depicted on the last column of Figure 11. Where the relative contribution of LO1 is the highest with 35%, then come LO2 with 33%, and LO3 and LO4 have the same contribution of 16% to the Program Outcomes.

From the student outcome evaluation form and faculty outcome evaluation form, an analysis of the course content, delivery and assessments was drawn. Once discrepancies are shown in the GAP matrix, an alert is made to have corrective action for the subsequent academic terms. The Course evaluation has several facets, first it looks at differences between student surveys results to faculty surveys results, then it concentrates on the relative contribution of each assessment to each Learning Outcome, to the contribution of each Learning Outcome to each Program Outcome, and finally to the relative contribution of each Learning Outcome to Program Outcomes.

The results from the mapped matrix were helpful in pinpointing exactly what assignment has contributed to the specified outcome, and what outcomes have been accomplished as well as which have not.

The overall teaching, learning and assessment strategies are well-thought out for the program. The cycle of program delivery assessment and continuous improvement ensures quality governance of the program on a term by term basis. This cycle has various frequencies, from weekly learner and faculty feedback to monthly school meetings, end-of-term meetings and annual program reviews with the Advisory Board members. It is suggested by the authors that this Matrix and Dashboard approach be expanded to additional course offerings in order to supply more examples and to test out its viability as a continuous improvement tool for Higher Education.

5. Conclusion

The design of the course and the syllabus are key components for the pre-delivery of the course. From these two aspects, course outcomes are derived and spelled out for a specific course to be delivered. In this model, the processes identify where the weaknesses are, where Learning Outcomes and/or Program Outcomes are not achieved. And, where a concentration is needed in order to achieve or get closer to the Key Performance Indicators (KPIs).

Once a course has been delivered for one semester, a benchmark for the course delivery (actually for this specific course) is generated given that it had met all criteria. This is part of Business Intelligence process, where the final table (Figure 11.) appear as a Dashboard for the Head of Department and/or Dean to analysis and take appropriate actions. The results identified as Benchmark, where they can be used as a base and with guidelines for the next semester of the course delivery. By using this method of continuous improvement with a mapped matrix and dashboard a clear picture of relative contributions can be seen following from student and faculty data to relative contributions by assessments to Learning Outcomes and then to Program Outcomes.

Acknowledgements

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