

# Alignment of Curriculum Elements at the Course Level : Two Useful Tools

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## ABSTRACT

The paper aims at highlighting the significance of alignment in teaching and learning (T&L) activities and processes. Focus is on alignment issues related to learning outcomes (LOs) and assessment at the course level of an undergraduate program in an outcome-based education (OBE) environment. Two tools commonly used at this level are focused on : the course plan (CP) and the course report (CR), the latter also assisting in providing feedback on the level of delivery and achievement of course LOs (CLOs). The general harmony of the contents of the tools with two academic accreditation criteria and standards is also considered. A number of mapping matrices and blueprints considered to be useful for aligning the various course level curriculum components are compiled to be included as part of the documents of the two tools.

**KEYWORDS** : Nawroz University (NZU), Alignment, Course Plan, Course Report, Learning Outcomes, Outcome-Based Education, Academic Accreditation.

## Definitions

**CLO** : a statement of what learners are expected to be able to do on successful completion of the course in order to demonstrate their knowledge, understanding, skills and/or competences.

**PEO** : program educational objective, a broad statement that describes what graduates are expected to attain within a few years of graduation. PEOs are based on the needs of the program's constituencies. (ABET : Accreditation Board for Engineering and Technology)

**PLO** : program learning outcome, is a statement of what learners are expected to know, understand or be able to do on successful completion of the entire program.

**Psychometrics** : assessment psychometrics is the measurement, analysis, and interpretation of performance across qualitative & quantitative assessment, using the best available evidence to provide appropriate and defensible standards.

**Reliability** : the extent to which a test will produce the same results upon repeated trials.

**Standard Setting** : the process used to set pass marks for assessments.

**Validity** : the extent to which a test actually measures what it intends to measure; the test is relevant, and the data collected is accurate and useful.

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## 1. Introduction

Higher education institutions (HEIs) in general have witnessed a number of developments in the T&L procedures and methods utilized over the last two or three decades. One major such development has been in the change from the traditional focus on the inputs to the current emphasis on outcomes. This has led to development of the OBE approach, generally seen as a method of curriculum design that focuses on LOs : what

students gained and can actually do after being taught. The LOs pyramid has the vision, mission, and objectives of the HEI at the top. PLOs then CLOs appear further down.

Curriculum may be defined as an instructional program that includes the components [4] :

- an educational goal or purpose
- objectives for each course in the curriculum
- statements of student LOs (SLOs)
- process for T&L
- means of assessment

The term 'alignment' is used to emphasize the importance of all the mentioned components of learning design being coherent. Addressing all these elements should be observed as far as possible.

Emphasis in this paper is on aspects and tools useful for assessment at the course level : CLOs, CPs, and CRs in particular. Naturally, the next level of assessment would be at the program level involving PLOs and then the preparation of program self assessment reviews/reports (SARs). Some issues involving the use of CPs and CRs are highlighted and linked to relevant accreditation criteria are presented in sections 2 and 3.

Section 4 presents a 'bundle' of matrices and blueprints for the purposes outlined above. These matrices are shown in tabular form in appendix II.

## 2. Learning Outcomes and Alignment

### 2.1 Learning Outcomes

Generally SLOs, which play a central role in OBE, may be classified into three types :

- General Education LOs (GELOs); at institution and/or program levels
- PLOs : at program level
- CLOs : at course level

GELOs, PLOs and PEOs for a given academic degree level may be derived in light of the characteristics of graduates and learning domain descriptions specified in the national qualifications framework (NQF), when such a local national framework exists. NQFs [8-10] describe what learners should know, understand and be able to do (i.e. LOs) on the basis of a given qualification level (e.g. bachelor level). Subsequently, accreditation standards may demand that program goals and outcomes to be consistent with the level of qualification awarded as defined in the NQF [3]. Compatibility of other curriculum components must also be observed, general education requirements for example.

Some accreditation agencies/commissions (e.g. ABET [1]) provide generic forms of PLOs that may be adopted, modified and/or appended with more program specific LOs.

Alternatively, PLOs may be specified in light of adopted accreditation standards, program objectives, and PLOs from other similar accredited programs.

The three LO types (i.e. GELOs, PLOs, and CLOs) are not mutually exclusive; for example some forms of GELOs may appear at PLO [1], or even CLO, level(s).

CLOs are commonly framed on Bloom's taxonomy or modifications of it [7]. One simple general format suitable for CLOs may be :

... students should be able to  
(action verb) (object) (modifiers)

for example , to

(assess) (the stability) (of a control system)

The level and type of the action verb, the object, and the modifier (either individually or collectively) in each CLO may be related to, or have an influence on, the

- content
- delivery
- assessment

of each course, and along with other courses may indicate how they meet the PLOs.

Other formats and taxonomies are also possible [7].

Distribution of CLOs over

- i. Bloom's levels, where emphasis may shift to higher level CLOs as students progress through a course and/or program reflecting the progressive nature of their learning
- ii. course contents
- iii. assessment/delivery methods and tool(s)

should be taken into consideration, where these aspects collectively may reflect the variation in assessment methods used, as well as the content validity and representativeness of LOs in an assessment.

### 2.2 Alignment

A key issue that needs to be dealt with in a course is centred on the question of whether

- the written contents,
- what is actually taught,
- what is learned by the students, and
- what the students are assessed in

are the same and/or properly aligned.

Such elements may be expressed in the form of 'special' matrices and blueprints that relate PEOs, PLOs, courses, individual CLOs, course contents, T&L activities, and methods of student assessment. Further evidence in the form of actual results is also a requirement.

These matrices and blueprints may be included as parts of two well established tools, namely

- CPs (also known as course syllabi)
- CRs and course files (CFs)

A CP communicates to students the course information before the course starts, while a CR is an instructor's review of the way the course was structured, taught and assessed at the end of a semester /year. The CR thus also represents a feedback tool to show, among other things, whether the course met its CLOs, and whether changes to the course are needed.

The accumulation of successive CRs for each course

constitutes a CF which represents the history of that course. The development and maintenance of comprehensive CFs within all programs is a key quality assurance (QA) tool.

Appendix I, through CAA stipulations 5 and 7, outlines examples of possible contents and purposes of CPs and CRs/CFs.

### 3. 'Alignment' in Accreditation Standards

All QA criteria and accreditation standards emphasize the importance of coherence of various curriculum elements, either explicitly or implicitly. These emphases are also reflected in the significance attached to the CPs and CRs/CFs. The following are extracts related to the matter at hand from the documents of two accreditation commissions/agencies, presented here only as illustrative examples, which explicitly demand the evidence through the CP and CR/CF tools.

#### 3.1 ABET <sup>[1,2]</sup> requirements and recommendations :

##### CRITERION 3. STUDENT OUTCOMES

- Description of how the student outcomes (PLOs ) prepare graduates to attain the PEOs.

##### CRITERION 4. CONTINUOUS IMPROVEMENT

- Listing and description of the assessment processes used to gather the data upon which the evaluation of each student outcome is based.

- Summaries of the results of the evaluation process and an analysis illustrating the extent to which each of the student outcomes is being attained.

##### CRITERION 5. CURRICULUM

###### A. Program Curriculum

- documentation of processes for regularly assessing and evaluating the extent to which the student outcomes are being attained.

- description of how the curriculum aligns with the PEOs.

###### B. Course Syllabi (CP)

- specific outcomes of instruction

- explicit indication of which of the student outcomes listed in Criterion 3 (i.e. PLOs ) or any other outcomes are addressed by the course.

### 3.2 CAA <sup>[3]</sup> (Note: Subsection numbers below refer to CAA standards)

#### . CAA on CP

The institution :

**3.3.3** provides LOs for each course that are consistent with current international norms in the discipline and the level of the course and the qualification awarded; and align with, and demonstrably meet, the program outcomes of each program in which the course appears;

**3.3.4** ensures that appropriate assessment tools are employed for the specified LOs;

**3.3.5** prepares detailed syllabi for all courses, including the information required in Stipulation 5 : Course Syllabi; (see appendix I)

#### . CAA on CR and CF

The institution :

**3.8.1** ensures that the delivery of each course is consistent with its detailed syllabus;

**3.8.2** ensures that the academic assessment of students is students is fair, accurate, aligned with LOs and program goals, and is undertaken at an appropriate level;

**3.8.3** maintains updated files for the delivery of each course, which include the information specified in Stipulation 7 : Course Files. (see appendix I)

### 4. Types of Matrices and Blueprints Involved in the Process

A number of related mapping matrices and blueprints are presented and linked to the tools under consideration. Generally, these usually fall into one of three categories :

i. General : related to the program and/or T&L activities; not specific to a course per se.

ii. CP : may be related to a given course and presented in the course plan of that course, providing useful information for students as well as faculty.

iii. CR : directly related to a given course reflecting actual data and information on the way that course was presented after the course is taught. These can be included as part of the course reports.

Table (1) below lists these three categories, which may be concluded in light of the criteria and requirements outlined in section3 :

**Table (1) : Categories**

Code	Matrix or Blueprint Title	Category : General/CP/CR
A	Mapping of PEOs with PLOs	General Mapping Matrix
B	Mapping of courses with PLOs	General Mapping Matrix
C	Alignment of CLOs with course contents	CP Mapping Matrix
D	CLOs of a course and PLOs	CP Mapping Matrix
E	Assessment methods and schedule for a course	CP Table
F	Distribution of course marks in an exam	General Blueprint
G	Assessment methods related to CLOs	General Blueprint
H	How CLOs were addressed by the various parts of the assessment tools	CR Matrix
I	Achievement of CLOs for a course	CR Table
J	Distribution of % of marks over course contents and CLOs in an assessment	CR Blueprint
K	Distribution of CLOs over Bloom's cognitive domain levels	General Blueprint
L	Mapping of CLOs with course T&L activities	General Blueprint

Appendix II shows these matrices and blueprints that are compiled from various sources, including some that have been used by the author in the past<sup>[11]</sup>. These are linked to table (1) by the codes in first column. Being listed in this manner does not imply that all should be used in a given course, nor that they may not be modified or no others may be added. These listings may serve as guidelines and reminders for instructors to, at least, bear these points in mind during the preparation and assessment processes of a course. Further, for these tools/matrices to be of significance would require more elaboration and must be supported by data, evidence, and justification.

### 5. Preparation of CP and CR documents

For each course being taught, the components of the two documents may be prepared in light of the descriptions given in appendix I with the inclusion of appropriate matrices and blueprints similar to those listed in table (1) and shown in appendix II, complete with the required data, supporting information, evidence and justifications in each case. The first document, i.e. CP, is to be prepared and approved before the course/semester starts and accordingly made available to the students. The second document, CR, should be compiled as soon as the course ends after the final exam results are announced. The accumulation of the CRs for each course over the semesters/years, leading to the development of CFs, would serve as useful means for review purposes.

### 6. Summary and Conclusions

"The alignment of intended SLOs and curricula is critical. If LOs are formally adopted but are not addressed in the curricula, the outcomes assessment process will be

worthless" <sup>[5]</sup>. The paper's focus has been on alignment issues of the assessment process. Further attention has to be given to ensure other important issues of assessment at the course level, namely validity, reliability, standard setting and assessment psychometrics in general <sup>[12]</sup>. The following conclusions are drawn from observations made during the early stages of considering the initiation of the OBE approach at Nawroz University (NZU) :

- It is recommended that all programs undergoing the OBE approach adopt some suitable formats for the CP and CR documents and the subsequent compilation of course files.
- The development and maintenance of comprehensive CRs and CFs, described as 'Cornerstones of Good Practice' in the QA process, should be encouraged.
- Use of blueprints in the design of student assessments based on relevant LOs ought to be adopted for achieving systematic and objective assessments.
- The performance of the faculty in dealing with alignment aspects and utilizing the tools ought to be monitored with the aim of guidance and improvements.
- The issues of 'how to write and measure attainment of CLOs', achievement of PLOs, program effectiveness and subsequent preparation of SARs have to be given due consideration.
- The role of QFs in the design of HEIs curricula needs to be established by developing an NQF.

### 7. Acknowledgements

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workshop, wishes to thank participants for their contributions and comments, which helped to enrich the material.

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### Appendix I

#### CAA Stipulations 5 and 7

##### Stipulation 5 : Course Syllabi

Each course syllabus should include :

1. course title and course code/number, credit hours (or equivalent), prerequisites (if any), co-requisites (if any);
2. name and contact information of instructor;
3. brief course description (as in the Catalog);
4. intended learning outcomes of the course;

5. course topics and contents on a week-by-week basis;
6. scheduling of laboratory and other non-lecture sessions, including online sessions, as appropriate;
7. information on out-of-class assignments with due dates for submission;
8. methods and dates of examinations and other student assessments, including the relative weight of various assessment elements in determining the course grade;
9. T&L methodologies, including any use of online instruction;
10. course texts, recommended readings, instructional material and learning resources.

##### Stipulation 7 : Course Files

Course files must include the following info, which may be in electronic form or hard copy :

1. syllabi for the current and previous offerings of the course;
2. copies of all instructor teaching materials;
3. copies of all assessment instruments;
4. instructor worked answers and marking schemes for all assessment instruments;
5. examples from across the range of student performance of graded responses to all assessment instruments;
6. a comprehensive instructor review of the presentation of the course, covering :
  - a. appropriateness of the course LOs;
  - b. extent to which the syllabus was covered;
  - c. extent to which LOs were met (with evidence);
  - d. appropriateness of textbooks and other learning resources;
  - e. appropriateness of assessment instruments in relation to LOs;
  - f. appropriateness of the balance of assessment;
  - g. appropriateness of prerequisites;
  - h. general comments on any problems encountered with the course;
7. quantitative analysis of student performance during the course presentation (e.g., grade distributions);
8. summary of student feedback on the evaluation of the course.

### Appendix II



**Matrices and Blueprints**  
**(Information/Data in all tables, matrices and blueprints below are hypothetical)**  
**General / Program**

**A. PEOs – PLOs mapping matrix**

PLOs	PEOs				
	PEO1	PEO2	PEO3	PEO4	....
PLO a	√		√		
PLO b		√		√	
...	√			√	
....	√				
PLO n			√		

**B. PLOs - Courses mapping matrix**  
**[may also indicate degree of linkage in each case]**

		PLOs						
Course #	Course title	a	b	c	d	..	..	..
CMSC204	Data Structures & A	√		√				
...								
	Computer Orgzn & A		√			√		
CMSC403	SW Spec& Design			√	√	√		
	DBMS	√	√	√			√	
.....	.....							

**CP**

**C. CLOs addressed in course contents/topics**

Course Contents		CLOs				
Week	Topics	1	2	3	4	
1	Introduction to the concepts of ..	√		√		
2	Fundamentals of ..		√			
..	....				√	√
15	'''			√		

**D. PLOs - CLOs alignment mapping matrix**

PLOs	CLOs			
	1	2	3	4
PLO a	√		√	
PLO b		√		
...				√
PLO n	√		√	

**E. Course assessment methods and schedule**

Activity	Assessment	Scheduled date	Remarks
Assignments/Quizzes	15%		
Test 1	10%		
Mid-Term Exam	20%		
Project/presentation	15%		
Final Exam	40%		
<b>Total</b>	<b>100%</b>		

## CR

## F. Distribution of marks in an exam

	Marks					
	>89	80-89	70-79	60-69	<60	Mean
No of students	5	4	10	3	3	73.2
% of students	20	16	40	12	12	

## G. Assessment tools for CLOs

CLOs	Assessment tool used		
	Assignment	Test/Exam	Other
Illustrate use of...	Assignmnt1	Mid Final	Exercise
Design oprns on..	Assignmnt2	Test2 Final	Project

## H. How CLOs were addressed by the assessment tools

E	CLO1	CLO2	CLO3	CLO4
Assignmnt 1	-	Q1	Q6	-
Assignmnt 2	Q6	-	Q4	Q5
Test 1	-	Q4	-	Q2
Final Exam	Q1	Q2	Q3	Q4
	Calc%	Calc%	Calc%	Calc%

## I. Achievement of CLOs

Levels	CLO1	CLO2	CLO3	CLO4	Overall
0-45%	Y	Y			
40-59%	X				
60-79%		X	X		X Y
80-100%			Y	X Y	

	CLOs	Level of Achievement
1	CLO1	45%
2	CLO2	60%
3	CLO3	70%
4	CLO4	80%

## General / T&amp;L

## J. Distribution of % of marks over topics and CLOs in an assessment blueprint

Topics	CLO1	CLO2	CLO3	TOTAL
Topic 1	5	5	5	15
Topic 2	10	-	15	25
Topic 3	20	20	-	40
Topic 4	-	15	5	20
TOTAL	35	40	25	100

## K. Distribution of CLOs over Bloom's cognitive domain levels

CLOs	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
CLO1	CLO1		CLO1			
CLO2		CLO2		CLO2		CLO2
CLO3				CLO3		CLO3
CLO4			CLO4		CLO4	
CLO5	CLO5			CLO5		

**L. Mapping of CLOs and T&L activities (only 2 CLOs shown)**

CLOs	Material :txtbk,ref,etc	Teaching Activities	Learning Activities
CLO2		Lecture	Reading, assignment ...
CLO2		Lecture, discussion	Reading, problem-based case
CLO3		Lecture plus activity	Presentation ...
CLO3	..	Lecture plus ...	..