

PROCEDURE FOR MEASURING ATTAINMENT OF COURSE LEARNING OUTCOMES – DIRECT MEASURES

The assessment process used to measure attainment of CLO's is described as under:

The assessment process uses both direct and indirect measures to measure the attainment of each outcome. The examples of such measures are given below:

Direct Measures

- Student Assignments
- Projects
- Examinations

In-direct measures: CLO Surveys

To assess each course, we use CLO's defined for that course. For example in Course A, we defined four CLO's (LO1 to LO4) that need to be met to successfully achieve that outcome at a minimum target performance level for a course. In each course, we assess the level of achievement of each course outcome. The data are then combined to analyze and evaluate the program level achievement of each program outcome. If any student outcomes are not met, action is taken for improvement.

In the section below, the assessment of course Inorganic Chemistry (PCY102) using CLO 1 is explained as an example. For example, at the course level, CLO1 reads

CLO 1: Chemistry of main group elements, and synthesis and properties of few main group compounds.

Attainment Assessment Process

The step by step process for assessing CLO's is tabulated below.

Step-by-step process for assessing Student Outcomes

Step 1: The Program coordinator analyses each course by breaking down into course learning outcomes and weightage and rating scale has been defined for each course. In addition, well designed surveys were used to assess each outcome.

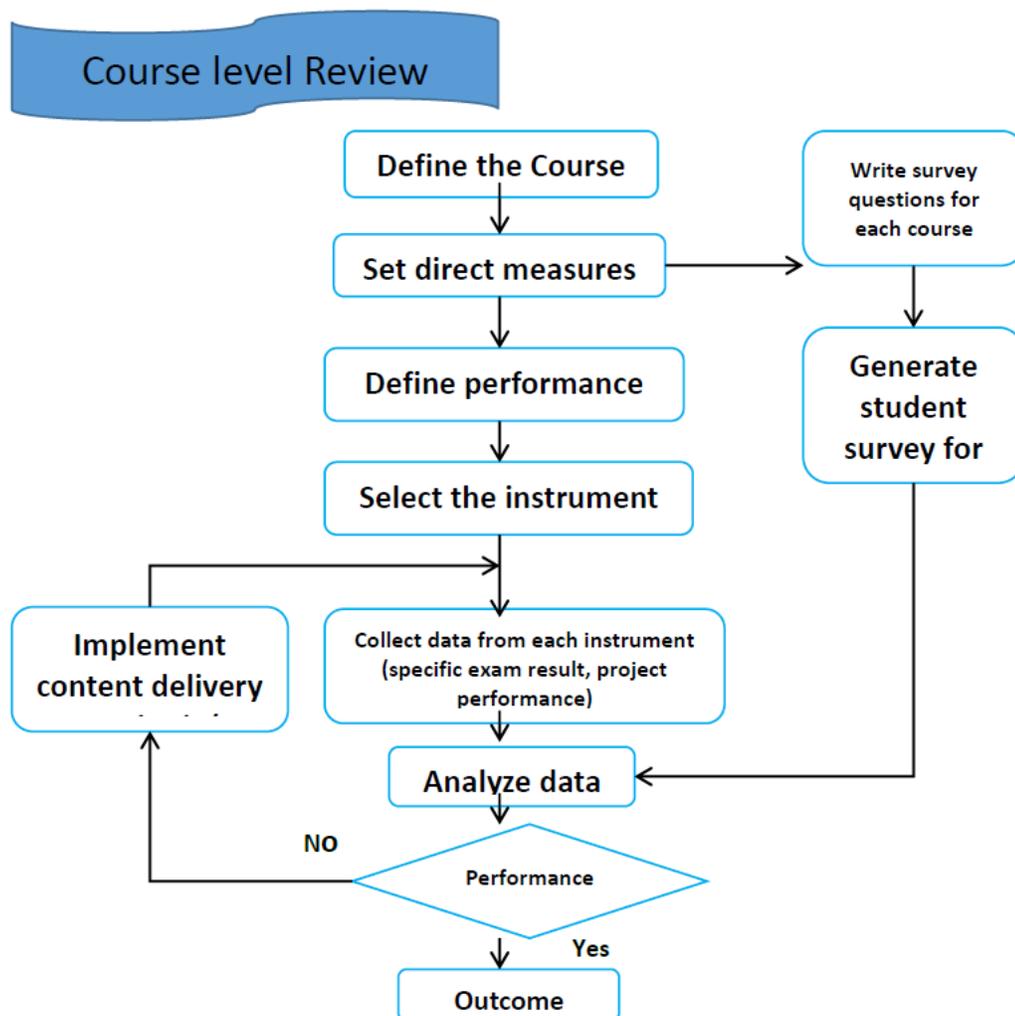
Step 2: For each outcome define performance indicators (Assessment criteria) and their targets.

Step 3: The module coordinators collect the qualitative and quantitative data and is used for outcome assessment in a continual process.

Step 4: The Program Assessment Committee analyzes the collected data. If the assessed data meets the targeted performance value specified in step 2, the outcome is attained.

Step 5: The Department of Academic Affairs Committee recommends content delivery methods/course outcomes/ curriculum improvements as needed. In case the targeted performance for some outcome is not met, a corrective action plan is put in place which serves as a feedback to the process for continuous improvement.

The procedure followed at the course level is depicted in the following flowchart diagram:



Assessment of attainment of CLO's for a course

Assignment/Examination level

Throughout the semester, the course instructor uses specific questions in tutorial or assignments, laboratories or examinations directly related to course outcomes. For example: in case of **Computer Aided Design** questions specifically targeting CLO1 were asked in end semester examination (EST). The student performance in this question is then summarized. At the end of semester, the course instructor looks at the overall performance of each student across all instruments used for evaluating each performance criterion.

The step by step assessment process for assessing the attainment of outcome for measuring attainment in course A using CLO1 is explained as under:

Assessment of course 'A' using CLO1

a.) Assessment Tool: Student's performance using course file

Course: Chemistry (PCY XXX)

From the course portfolio the instructor identified the following question (Question No.:4 asked in EST, weightage 50 marks) specifically targeting CLO1 for assessing student's competency in achieving course outcome 'CLO1'.

Question: ES Q4

4. (a) Describe the structure of $[\text{XeF}_2]$ and IF_3 , with the help of hybridization involved.
- (b) Complete and balance the following reactions:
(i) $\text{XeF}_6 + \text{H}_2\text{O} \rightarrow ?$ (ii) $(\text{C}_6\text{H}_5)_2\text{S} + \text{XeF}_2 \rightarrow ?$
- (c) With the help of skeletal electron count classify the following boranes:
(i) $[\text{B}_8\text{H}_8]^{2-}$ (ii) B_5H_9 (iii) $\text{C}_2\text{H}_2\text{B}_{10}\text{H}_{10}$ (iv) $\text{B}_{10}\text{H}_{14}$
- (d) With the help of at least two chemical reactions show the similarity between halogens and pseudohalogens.
- (e) Complete and balance the following reactions:
(i) $\text{B}_{10}\text{H}_{14} + \text{R}_2\text{S} \rightarrow ?$ (ii) $\text{B}_2\text{H}_6 + \text{NH}_3 \rightarrow ?$ (4 x 5)

The student performance in the above question is then analysed and the instructor scores the performance of each student using 1 to 5 rubric as shown in Table 1 below. Student's performance in the above question is given below:

Table 1: Student's performance in question targeting 'CLO1'; course: PCYXXX

S.No.	Roll Nos.* <i>*protected due to privacy reasons</i>	Names* <i>*protected due to privacy reasons</i>	EST Q4 Marks (20)	Score (1-5)
1	01	Student AA	8	4
2	02	Student AB	10	4
3	03	Student AC	3	2
4	04	Student AD	14	4
5	05	Student AE	5	3
6	06	Student AF	13	4
7	07	Student AG	13	4
8	08	Student BA	17	5
9	09	Student BB	7	4
10	10	Student BC	9	4
11	11	Student BD	14	4
12	12	Student BE	11	4
13	13	Student BF	13	4
14	14	Student BG	0	1
15	15	Student CA	11	4
16	16	Student CB	3	2
17	17	Student CC	7	4
18	18	Student CD	12	4
19	19	Student CE	6	3
20	20	Student CF	8	4

21	21	Student CG	3	2
22	22	Student DA	12	4
23	23	Student DB	13	4
24	24	Student DC	7	4
25	25	Student DD	12	4
26	26	Student DE	5	3
27	27	Student DF	10	4
28	28	Student DG	17	5
29	29	Student EA	4.5	3
30	30	Student EB	6	3
31	31	Student EC	15	4
32	32	Student ED	4	2
33	33	Student EE	13	4
34	34	Student EF	2.5	2
35	35	Student EG	19	5
36	36	Student FA	6	3
37	37	Student FB	16	5
38	38	Student FC	0	1
39	40	Student FD	11	4
40	41	Student FE	1	1

The rating on a scale of 1 to 5 has been done using a rubric (given below) which gives a score of 5 to top performers and 1 to poor performers. Accordingly scale of 2, 3 and 4 can be used for those in the middle. The overall performance of students in the above question is then summarized as given below.

DIRECT MESUREMENT (USING STUDENT PERFORMANCE)										
SCALE TO BE DEFINED BY COORDINATOR			1`S	2`S	3`S	4`S	5`S	TOTAL	DIRECT MESUREMENT AVERAGE SCORE	
Range of marks	LIMIT	Score	3	5	6	22	4	40		
>15 UP TO 20	15	5								
>15 UP TO 10	6	4	1%	2%	3%	4%	5%	CHECK		
>10 UP TO 5	4	3	7.5	12.5	15.0	55.0	10.0	100.0		3.48
>5 UP TO 3	2	2								
>=0 UP TO 2	0	1								

After completing this assessment directly from the questions given to students using various instruments, we also use in-direct instruments which include student course survey to get to a final assessment score for each CLO. These scores for each CLO are then summarized to obtain the attainment level for each student outcome.

The assessment completed using the surveys for CLO 1 is also provided below:

Assessment Tool: Course survey

Average score of student course survey for CLO1; course: PCYXXX

INDIRECT MEASUREMENT (SURVEY BASED)						
1`S	2`S	3`S	4`S	5`S	TOTAL	INDIRECT MEASUREMENT AVERAGE SCORE
1	2	16	11	2	32	
1%	2%	3%	4%	5%	CHECK	
3.1	6.3	50.0	34.4	6.3	100.0	

Step 3- (a) Weighted average from CLO's

There were three CLO's which were used to assess the attainment of course objectives for course A. The course instructor(s) then decide that each CLO contributes to attainment does so at a varying level. The faculty assigns weight on a scale of 1 to 5, describing how each CLO contributes to a particular course. Using these weights and scores from each CLO for the course, we compute the weighted average score for the CLO's using direct measurement. The sample calculation for evaluation of weighted average score of CLO 1 to CLO 4 using direct measurement is given below:

TABLE: Weighted Average Student class performance (course portfolio) for CLO 1 to CLO 4 for PCYXXX							
	% of student in each score					Average Score	WEIGHT
	1	2	3	4	5		
CLO1	7.5	12.5	15.0	55.0	10.0	3.48	4
CLO2	30.0	15.0	22.5	22.5	10.0	2.68	4
CLO3	2.5	30.0	25.0	27.5	15.0	3.23	4
CLO4	2.5	0.0	27.5	47.5	22.5	3.88	5
Weighted average score (Direct measurement)						3.35	

(b) Weighted average from student course survey

Assessment Tool: Course Survey

TABLE: Weighted Average Student course survey for CLO 1 to CLO 4 for PCYXXX							
	% of student in each score					Average Score	WEIGHT
	1	2	3	4	5		
CLO1	3.1	6.3	50.0	34.4	6.3	3.34	4
CLO2	3.0	0.0	36.4	51.5	9.1	3.64	4
CLO3	3.0	3.0	24.2	39.4	30.3	3.91	4
CLO4	3.1	3.1	50.0	34.4	9.4	3.44	5
Weighted average score (Indirect measurement)						3.57	

Step-4: Overall weighted average score for CLO attainment for course A (for example CLO1 to CLO4 in this case)

The program faculty decided to assign weights to each assessment tool. Using these weights along with weighted average student class performance, weighted average student course survey score (from tables above) and the score, we computed the weighted average for each course and is given in Table given below.

Table: Overall weighted average score of course A

TABLE 6: Overall weighted average score of course PCYXXX

Assessment tools	Average weighted score	Assessment tool Weight
Weighted average student class performance	3.35	5
Weighted average student course survey	3.57	5
The overall score for attainment of CLO's in PCYXXX is thus		3.462

Overall weighted score for performance criteria is given by

$$\text{Overall} = [3.35 \times 5 + 3.57 \times 5] / [5+5] = 3.462$$

The overall score for attainment of CLO's in course PCYXXX is thus 3.462 on a scale of 1 to 5.

Following is a bar plot of the CLO scores obtained for a few representative M.Sc. (Chemistry and Biochemistry) courses that were taught during 1718 EVEN SEM.

