Assessment of Students' Achievement of Learning Outcomes by using Different Assessment Approaches

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ABSTRACT

The present study was conducted on 1rtyear, radiological sciences students at Najran University to evaluate the achievement of undergraduate radiological sciences students in the CLOs assessment. Learning outcomes assessment for Introductory Physics 204 PHST-2 Year I at Department of Radiological sciences, Najran University was conducted by direct methods and compared the results of students' achievement of the course learning outcomes by using different assessment approaches. The study was applied on30 students who enrolled in the course during academic year 2019-2020.Direct measurement was applied by linking of each CLO to exams questions on quizzes, midterm exams, final exams and Lab reports. The current study emphasizes that, both of the average and threshold approaches can examine the overall performance of the course, while the performance vector approach can display the distribution of students' achievements of the course.

KEYWORDS: *Course Learning Outcomes, assessment, average, threshold, vector performance*

INTRODUCTION:

Outcomes based education (OBE) is a process that involves revising of the curriculum and assessment methods to reflect the achievement of high order learning[1].All curriculum and teaching decisions are made based on how best to facilitate the desired final outcome [2],[3].The unambiguous outcome is used to plan the curriculum, monitor its implementation, evaluate it and assess student's achievement [4]. In outcomes-based education, the learning system should align the teaching methods and the assessment, and CLOs are achieved [5]-[7].

Combination of three approaches (average, threshold and performance vector) to evaluate the CLOs achievement were used in previous studies [8]-[10].Best practices for aligning assessment with learning outcomes, compares common testing modalities and the how to measure the outcome of student learning could be discussed by Jonathan D Kibble [11].

The calculating of CLOs is conducting by using a direct assessment method, and using these collected results as a catalyst for change and improvements, such as revising curricula and courses structure, improving the learning activities and enhancing the faculty teaching skills.

Direct assessment methods available to measure student learning outcomes include locally developed exams that specifically track learning outcomes to student performance demonstrated by answers to specific exam questions, portfolios with rubrics, and capstone projects with rubrics [12]. Average, threshold, and performance vector approaches were used for CLOs assessments [13]-[15].

The aim of the present study is calculating the student's achievement of course learning outcome of introductory physics course in applied medical sciences college by applying the three different assessments approaches. The assessment is a process of collect data to evaluate the attainment of PLOs. Different types of assessment are used to measure PLOs and CLOs as direct and indirect methods [16]-[19].A novel method evaluates the attainment level for course outcomes as well as program outcomes could be proposed by Sudheer et al [20].The result of CLOs measurements is used to assess the achievement of PLOs and to promote the quality of the teaching and learning processes in the specified course.

The courses are mapped to PLOs by examining individual learning outcomes of each course. The students' achievement of CLOs of each course are assessed. Every PLO is evaluated individually based on data collected from courses' exams results, faculty, students, alumni, internship, and employers to measure its performance level [18],[21].

Methodology

204PHST-2 course is compulsory for radiological sciences students in Year I in applied medical sciences college at Najran University. 204 Physt-2 course is described by five CLOs which covered its topics. CLOs are listed in Table 1.

Table 1: CLOs statements

	Statement
CLO1	Identify the units and dimensions of the physical quantities.
CLO2	Explain the fundamental principles of mechanics, dynamics, energy, and momentum.
CLO3	Analyze the basic principles of electrical circuits and electromagnetic fields.
CLO4	Operate basic Laboratory equipment and collect data.
CLO5	Use graphical models to analyze laboratory data.

Every CLO is assessed by at least by two assessment methods. The variation in the relative weight of each CLO is identified according to the weight of the topics covered by the CLO of the course. Data was collected on those assessments (exams, quizzes and lab reports) and analysed to evaluate the scores of students due to their achieving the CLOs. Three assessment approaches were applied to calculating CLOs of 204 PHST-2 course and the results of 30 enrolled students in that course were collected and analysed.

From the assessment results, many activities can be organized such as revising and improving the learning outcomes, developed the learning activities and resources as well as promote the faculty teaching skills [22]-[24].

The first assessment approach is the average approach, where the score average of students should exceed the success criteria, where the success criteria is (60%) that is according to Najran University examinations rules. The second assessment approach is the threshold approach, where the high number of the students should exceed the success criteria. In the current study, 100% of the students are expected to achieve ≥60% for a specified assessment. The performance vector is the third approach, it is based on a performance assessment scoring rubric[13].The combination approaches of average, threshold, and performance vector was introduced in previous studies [13]-[15].The topics covered are mapped clearly to the CLOs, the assessments methods and the percentages of coverage of each topic are identified. The assessment methods for CLOs and their relative weights are presented in the following Table;

Table 2: The relative weight (%) for each CLO and assessment methods

	Assessment methods	Relative weight	Total
CLO1	Quiz	2.5	17.5
	Midterm written exam	5	
	Final written exam	10	
CLO2	Midterm written exam	15	15
	Final written exam	10	
CLO3	Quiz	2.5	22.5
	Final written exam	20	
CLO4	Midterm practical exam	6	18
	Final practical exam	12	
CLO5	Midterm practical exam	4	17
	Final practical exam	8	
	Lab reports	5	
Total		100	

Assessment of the results are provided and actions to be taken are suggested[25].

At the end of the semester in which the course is taught the instructor should prepare the course report.

Results and Discussion

A detailed analysis of students' achievement of CLOs based on the average approach of 204 PHST-2 course for students enrolled in academic year 2019-2020 was performed and is tabulated in Table 3.

The results in Table 3 show the achievement of CLOs based on the average approach, where the success criterion equal 60% as based in Najran University. It is shown from results in Table 3, the students achieved all CLOs of 204 PHST-2 course of first semester in academic year 2019-2020.

The students achieved CLO5 with the highest value, where they rated 71.796%, while CLO3 was achieved with the lowest value (61.937%).

Also, the students achieved CLO1, CLO2 and CLO3 with rate equal 66.420%, 67.384% and 67.149% respectively.

On the other hand, the analysis of achievement of CLOs based on the threshold approach of 204 PHST-2 course is tabulated in Table 4.

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Table 3: Students achievement of CLOs based on the average approach

	Quiz1	Quiz2	Midterm (written exam)	Midterm (practical exam)	Lab Reports	Final (written exam)	Final (practical exam)	CLO (%)
CLO1	68.32		63.166			67.775		66.420
CLO2			63.733			71.034		67.384
CLO3		65.332				58.542		61.937
CLO4				56.527			77.7708	67.149
CLO5				62.917	73.833		78.637	71.796

Table 4: Students achievement CLOs based on the threshold approach

Percentage of Students Who Exceed the Threshold Value of 60%								
	Quiz1	Quiz2	Midterm (written exam)	Midterm (practical exam)	Lab Reports	Final (written exam)	Final (practical exam)	CLO (%)
CLO1	60.0		46.666			83.33		63.332
CLO2			60.0			66.66		63.33
CLO3		53.333				60.0		56.667
CLO4				66.666			80	73.33
CLO5				60.0	73.333		90.0	74.443

Table 4 shows the results of achievement of CLOs based on the threshold approach; the students achieved all the CLOs of 204 PHST-2 course expect CLO3. The students achieved CLO5 with the highest value, where they recorded 74.443%.While CLO3 was achieved with the lowest value equal56.667%. In addition, the students achieved CLO1, CLO2 and CLO4 with rates equal 63.332 %, 63.33 %and 73.33 %respectively. According to the obtained results, the achievement of CLO3 did not reach the target value and it needs action plan for improvement.

The analysis of achievement of CLOs based on the vector performance approach of 204 PHST-2 course is tabulated in Table 5.

Table 5: Students achievement CLOs based on the vector performance approach

Number and percentage of Students Based on the Performance Level								
	E ≥80%		M ≥70%		A ≥60%		U <60%	
	No.	%	No.	%	No.	%	No.	%
CLO1	4	13.333	15	50.0	25	83.333	5	16.666
CLO2	7	23.33	16	53.33	25	83.333	5	16.666
CLO3	4	13.333	11	36.666	20	66.66	10	33.333
CLO4	6	20.00	19	63.33	25	83.333	5	16.666
CLO5	12	40	19	63.333	26	86.66	4	13.333

Table 5 display the results of achievement of CLOs based on the performance vector approach.

The results show that, the students achieved CLO5 with highest value compared to the other CLOs, where 12 students achieved CLO5 with rate equal ≥80%. So, the percentage of students who join to excellent category is 40 %.

In addition, according to the students' achievement result of CLO5, only 4 students belong to unsatisfactory categorywith rate equal 13.33 %.

CLO2 rated the second score of achievement, where the number of students in excellent category is 7 students. They joined to the excellent category with rate equal 23.33 %, while the number of unsatisfactory students is 5 with rate equal 16.66%.

CLO4 is achieved by 6 students in excellent category with rate equal 20%, while 5 students joined to the unsatisfactory category with rate equal 16.66%.

CLO1 and CLO3 are achieved by 4 students in excellent category with rate equal 13.13% per each. But, 5 students joined to the unsatisfactory category with rate equals 16.66% for CLO1, while the ratio of unsatisfactory students is doubled to reach 33.33% for CLO3.As mentioned earlier, CLO1 and CLO3 were achieved with an equal number of excellentstudents, but the different number of unsatisfactory students. Where the highest number ofunsatisfactory students was related to CLO2.

All the collected results of CLOs assessment are grouped and tabulated in a table 6 and presented in Course Report (Course Performance Report) [13]-[15].

Table 6: Course Performance Report

	CLO (%)	CLO (%)	CLO % Performance Vector				CLO Attainment	
	Average approach	Threshold approach	E	A	M	U	Met	NOT Met
CLO1	66.420	63.332	4	15	25	5	√	
CLO2	67.384	63.33	7	16	25	5	√	
CLO3	61.937	56.667	4	11	20	10		√
CLO4	67.149	73.33	6	19	25	5	√	
CLO5	71.796	74.443	12	19	26	4	√	

Based on the obtained results, if a CLO average or threshold score was above the success criteria, and the number of unsatisfactory students was less than 20%, the CLO is achieved and it is met the requirement of the CLO [13].

But a CLO average and threshold below the success criteria or the number of students with unsatisfactory level are more than 20%, the CLO is not achieved and it is not met the requirement of the CLO. Accordingly, the CLO needs action plan for improvement [13].

Table 6 compares the values of CLOs assessment of 204 PHST-2 course. From the findings of Table 6, it is clear that CLO5 rated the highest values comparing to the other CLOs by using the three approaches, where CLO5 recorded 71.796 %, 74.443% for average and threshold approaches, respectively. And it achieved highest number of students (12) in excellent category (40%), and lowest number of unsatisfactory students (4) with percentage equal 13.33%.

On the contrary, CLO3 rated the lowest values comparing to the other CLOs by using the three methods, where it recorded 61.937%, 56.667 % for average and threshold methods respectively. And it achieved highest number of students in unsatisfactory category 10 with percentage equals 33.333%.

The students' achievement of CLO1 recorded 66.420%, 63.332 % for average and threshold approach respectively. And it achieved 4 students in excellent category with rate equals 31.33% and number of unsatisfactory students is equal 5 with percentage 16.66%. The students' achievement of CLO2 recorded 67.384%, 63.33% for average and threshold method respectively.

And it achieved 7 students in excellent category, represented 23.333% and 5 unsatisfactory students with percentage 16.66%. The results of assessment of CLO4 recorded 67.149 % and 73.33% for average and threshold method respectively. And it achieved 6 students in excellent category, represented 20% and 5 unsatisfactory students with percentage 16.66%.

Finally, the above results indicate that CLO3 needs action plan for improvement to closing the loop, this process is used to improve the teaching and learning quality at course and program levels.

Conclusion

Overall, different assessment approaches were carried out to assess the CLOs of 204 PHST-2 course as compulsory course for radiological sciences students in Year I, and have been successfully implemented in first semester in 2019-2020. The obtained results show that the different approaches of assessment of CLOs have almost consistent results for each CLO.

In general, the difference in the achievement value of every CLO by using average and threshold approaches for this course lies between 2.6 – 6.2%.

The present study agrees with Nurakmal Ahmad et. al [15] and Alzubaidi et. al [13], where the three different approaches can assess the achievement of the CLOs through the direct assessment methods of CLOs. Also, the average and threshold approaches can identify a limitation rate to assess the CLOs achievement. Both the average and threshold approaches can examine the overall performance of the course, while the performance vector approach can display the distribution of students' achievements.

The findings from this study are based on a comparison between the collected data of CLOs achievement by using different assessment approaches. And the results are enhancing faculty skills on teaching and learning processes and the assessment experience.

Ethical Approval

After approval of the research proposal by the deanship of scientific research, it was reviewed by Najran University ethical review panel. A formal approval to carry out the study was obtained from the Dean of Applied Medical Sciences College to conduct the study after an explanation of its objectives. Informed consent was taken from each student. All data was confidential and used for the research purpose only.

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