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From Program Goals to Student Achievement: A Framework for Mapping and Weighting Course Learning Outcomes in Electrical Engineering Program

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Abstract

This paper presents a systematic approach for directly assessing student learning outcomes in the Electrical Engineering program at the Al Neelain University. The focus is on aligning program learning outcomes (PLOs) with course learning outcomes (CLOs) and developing a method for calculating the numerical weight of each CLO based on its contribution to the overall assessment scheme. This method allowsfor a more accurate and transparent evaluation of student achievement and program effectiveness, ultimately supporting the university's pursuit of accreditation.

Keywords: Accreditation, Assessment Methods, Learning Outcomes, Direct Assessment Method, Electrical Engineering, Program Learning Outcomes, Course Learning Outcomes

1. Introduction

Accreditation plays a crucial role in ensuring the quality of engineering programs and preparing graduates for their professional careers. Universities worldwide strive for accreditation from recognized bodies like the Accreditation Board of Engineering and Technology (ABET) to demonstrate the quality of their programs and enhance graduate employability [1]. ABET accreditation emphasizes the assessment of student learning outcomes, requiring programs to demonstrate that graduates have achieved specific knowledge, skills, and abilities [2].

Outcome Based Education (OBE) provides a framework for achieving specific learning outcomes and measuring student performance [3]. OBE emphasizes the importance of aligning program learning outcomes (PLOs) with course learning outcomes (CLOs) to ensure that each course contributes directly to the program's overall learning goals [4]. This alignment is crucial for effective direct assessment, which involves measuring student achievement against specific learning objectives [5].

Several studies have explored methods for assessing learning outcomes in engineering programs. Some focus on developing assessment tools and rubrics [6], while others explore the use of mathematical models to evaluate program and course learning outcomes [7].

The work in [1] showcases a systematic approach to assessing student learning outcomes in mathematics, specifically within a differential equations course. By defining measurable performance indicators for selected ABET student outcomes and developing both direct and indirect assessment tools.[8]proposes a structured method for assessing ABET student outcomes "a" and "e" in mathematics and science courses for engineering students. By breaking down the outcomes into measurable components, aligning them with course goals, and using both direct and indirect assessments, this method allows for a comprehensive evaluation of student achievement and informs quality assurance efforts. The study [9] proposes a refined method for evaluating program outcome (PO) attainment in engineering programs, incorporating the credit weight factor (CWF) of curriculum components to provide a more accurate assessment of program effectiveness. By analysing the curriculum to determine CWF for each component and measuring PO attainment through direct and indirect assessments as well as student perceptions via the Graduate Exit Survey, this method calculates a weighted average of PO attainment, giving greater importance to components with higher credit weight. [10] developed the Rasch measurement model and utilized it to analyse students' final exam scores with the goal of categorizing their performance based on their test grades. In essence, the Rasch model relies on the assumption of uni-dimensionality. Consequently, if the exam evaluates multiple skills or knowledge domains, the model's accuracy in prediction may diminish. The study in [11] proposes a direct method for measuring program and course learning outcomes in Indonesian higher education. The authors assigned a weight to the correlation between program learning outcomes and course outcomes, leading to a significant responsibility for instructors in formulating exam questions. This weighting may differ based on the type of question in the exam, resulting in inconsistencies in the assessment tools employed. In contrast, our approach calculates the weight for course learning outcomes directly based on the proportion of this course's learning outcomes distributed across all assessment tools utilized in the course.

However, there is a need for a systematic approach that not only aligns PLOs and CLOs but also provides a clear and transparent method for calculating the weight of each CLO in the overall assessment scheme.

This paper addresses this gap by presenting a method for directly assessing student learning outcomes in the Electrical Engineering program at the Al Neelain University. The focus is on aligning PLOs with CLOs and developing a method for calculating the numerical weight of each CLO based on its contribution to the overall assessment scheme. Specifically, this study seeks to answer the following research questions:
RQ1: How can PLOs be effectively aligned with CLOs in the Electrical Engineering program?
RQ2: How can the numerical weight of each CLO be calculated based on its contribution to the overall program learning outcomes?
RQ3: How can the proposed method be used to assess student achievement and inform program improvement efforts?

By answering these research questions, this study aims to develop and implement a systematic and transparent approach for directly assessing student learning outcomes in the Electrical Engineering program. This approach will support the university's pursuit of ABET accreditation and contribute to the continuous improvement of the program.This method allows for a more accurate and transparent evaluation of student achievement and program effectiveness, ultimately supporting the university's pursuit of ABET accreditation.

2. Methods

This study employs a quantitative approach to analyze and assess student learning outcomes in the Electrical Engineering program. The proposed method, designed to align PLOs with CLOs and calculate the numerical weight of each CLO, is implemented through the following steps:

2.1. Mapping PLOs to CLOs

The established PLOs for the Electrical Engineering program and CLOs for each course in the program are identified and reviewed to ensure they are clearly defined and measurable, see Table 1-3 below which demonstrates the formulated CLOs for ‘Electric Circuit analysis’ course based on different identified domains.

Course Learning Outcomes (CLOs)	CLOs Statement
K 3.1	**Express** the sinusoidal electrical quantities and parameters mathematically for 1-phase/3-phase AC circuits
K 3.2	**Illustrate** circuit element models using Laplace transform
K 3.3	**Describe** circuit frequency response using transfer function
K 3.4	**Describe** Two-Port networks and magnetically coupled circuits
K 3.5	**Classify** different types of transient analysis in electric circuits
K 3.6	**State** the different configurations of OP-AMP
S 2.1	**Analyse** and **interpret** the sinusoidal electrical quantities and parameters for 1-phase/3-phase AC circuits
S 2.2	**Apply** Laplace transform in analysis of electric circuits
S 2.3	**Determine** circuit frequency response of a linear networks
S 2.4	**Analyse** different kinds of two-port networks and filter circuits
S 2.5	**Solve** and **analyse** magnetically coupled circuits and transient analysis in electric circuits
S 2.6	**Compare** different configurations of OP-AMP

Table 1: Electric Circuits Analysis Course Learning Outcomes

Program: Electrical Engineering	Year-4, Semester-7, Section-74XX	Domain to be covered.
Domain No.	**categories**	**Domain Name**
D-1	K1 K2 K3	Knowledge and understanding
D-2	S1 S2 S3	Cognitive skills
D-3	I1 I2	Interpersonal skills and responsibility
D-4	C1 C2	Communication, Information technology, and numerical skills.
D5	P1	psychomotor

Table 2: Program Learning Outcomes Domain & Categories

Program: Electrical Engineering	Year-4, Semester-7, Section-74XX	Domain to be covered.
code	**Domain No.**	**Domain name / CLOs statement**
K3	D-1	Knowledge
K3.1		Describe circuit frequency response using transfer function.
K3.2		State the different configurations of OP-AMP.
S2	D-2	Cognitive skills
S2.1		Apply Laplace transform in analysis of electric circuits
S2.2		Analyse transient state of series and parallel electric circuits.

Table 3: Samples of CLOs for “Electric Circuits Course”

Program: Electrical Engineering	Year-4, Semester-7, Section-74XX	Program Learning Outcomes PLOs
Course-A Learning outcomes	**Program learning outcomes code**	**By the end of the program the student will be able to demonstrate sound knowledge of:**
CLO-1 CLO-3 CLO-4	PLO-1	Mathematics, science, and engineering fundamentals relevant to electrical engineering specialization.
CLO-1 CLO-5	PLO-2	Information Processing including the analysis and syntheses of circuit and signal processing systems, the use of appropriate computer digital and analogue control techniques.
CLO-3 CLO-4	PLO-3	Apply the fundamentals and theories of electrical engineering to solve (with proper notations) and analyses electrical systems of limited size using efficient and effective solutions and analysis methods.

Table 4: Align PLOs to CLOs

Each CLO is then mapped to at least one PLO, creating a clear link between course-level learning and the program's overall learning goals. This mapping is often visualized using a matrix or table.

2.2. Distributing CLOs to Assessment Tools

Various assessment tools such as exams, quizzes, assignments, projects, and presentations are identified for each course, as shown in Table 4 below.

Each CLO is then assigned to the assessment tool(s) best suited for measuring the specific knowledge and skills it targets. This ensures that each CLO is assessed by at least one appropriate tool.

Course code:7414, Credit Hrs.3, No. of Week:15	Year-4, Semester-7, Section-74XX
Assessment Tools	**Course learning outcomes (CLOs)**
Assignment, Midterm1, Final Exam	K3.1, S2.1
Assignment, Midterm1, Final Exam	S2.2
Midterm1, Quiz, Final Exam	K3.2, S2.2
Assignment, Midterm1	S2.2, S2.3
Midterm2, Final Exam	K3.1, S2.3
Assignment, Midterm2, Final Exam	K3.1, K3.2, S2.1, S2.2
Assignment, Quiz, Midterm2	K3.1, S2.1, S2.3

Table 5: Course A Topics with CLOs Assigned to Each Assessment Tool

2.3 Calculating Numerical Weights for CLOs

This study aimed to determine the numerical weight of each course learning outcome (CLO) within each assessment tool used in the course. To achieve this, the following steps were undertaken:

a. Mapping CLOs to Assessment Tools:
The CLOs, denoted as K3.1, K3.2, S2.1, S2.2, and S2.3, were mapped onto the four assessment tools: Midterm 1, Midterm 2, Quizzes, and Final Exam. This mapping identified which CLOs were assessed by each tool.

b. Calculating CLO Frequency:
The frequency f_{clo_i} of each CLO was calculated by counting the number of times it appeared across all assessment tools. This provided an indication of how often each CLO was assessed throughout the course.

c. Determining Total Frequency per Assessment Tool:
For each assessment tool, the summation of all CLO frequencies Sf_{all} was calculated. This represented the total number of CLOs assessed by that specific tool.

d. Calculating Repetition Percentage:
The repetition percentage $PCLO_i$ for each CLO within each assessment tool was calculated using.

$$PCLO_i = \frac{f_{clo_i}}{Sf_{all}} \quad (1)$$

This percentage indicated the relative emphasis placed on each CLO within the specific assessment tool.

e. Determining Numerical Weight:
Finally, the numerical weight W_n of each CLO in each assessment tool was calculated using the formula:

$$W_n = \frac{PCLO_i}{100} \times N \quad (2)$$

Where N is the total mark of the specified assessment tool.

This calculation provided a quantitative measure of the contribution of each CLO to the overall assessment score for each tool.

By following these steps, the numerical weight of each CLO within each assessment tool was determined, allowing for a more nuanced understanding of how the course learning outcomes were assessed and weighted throughout the course.

2.4. Determining the Percentage of Achievement for Each CLO

Student performance on each assessment tool is evaluated and translated into a numerical score. These scores are then multiplied by the corresponding CLO's weight to obtain weighted scores.

The weighted scores for each CLO are summed up to obtain the total weighted score for the course.

The percentage of achievement for each CLO is calculated by dividing the total weighted score by the maximum possible weighted score and multiplying by 100.

$$Achv. = \frac{M_{s_1} + M_{s_2} + \cdots + M_{s_r}}{r \times W_n} \times 100, \quad (3)$$

Where *Achv.* represents the CLO achievement, and M_{s_r} is the mark obtained by student r in the specified CLO.

2.5. Comparing Actual Achievement with Target and Benchmark Values

Target and benchmark values are established for each CLO, representing the desired level of student achievement based on program goals, industry standards, or other relevant benchmarks.

The calculated achievement percentages for each CLO are then compared to these target and benchmark values. This comparison identifies areas where students excel or struggle, informing the development of improvement strategies.

3. Results

The proposed method was applied to the "Electric Circuits Analysis" course in the Electrical Engineering program. This course was chosen as an illustrative example due to its central role in the curriculum and its diverse assessment methods.

3.1. Mapping PLOs to CLOs

The course learning outcomes (CLOs) for "Electric Circuits Analysis" were mapped to the program learning outcomes (PLOs) for the Electrical Engineering program. This mapping demonstrated that the course contributes to several PLOs, including:
PLO 1: Knowledge and understanding of mathematics, science, and engineering fundamentals relevant to electrical engineering.

PLO 2: Ability to analyze and synthesize circuit and signal processing systems.
PLO 3: Ability to apply the fundamentals and theories of electrical engineering to solve and analyse electrical systems. Table 6 below illustrate the mapping process for "Electric Circuit Analysis" Course.

Program: Electrical Engineering	**Course learning outcomes statements**	**Year-4, Semester-7, course code: EE212, "Electric Circuit Analysis"**	**Program learning outcomes statements**
Course-A Learning outcomes	By the end of the course the student will be able to demonstrate sound knowledge of:	Program learning outcomes code	By the end of the program the student will be able to demonstrate sound knowledge of:
K3.1	Express the sinusoidal electrical quantities and parameters mathematically for 1- phase/3-phase AC circuits	K3	Energy conversion including power conversion and electrical machine, basic engineering skills of workshop technologies, laboratory, and physical field experience.
K3.2	**Illustrate** circuit element models using Laplace transform		
	By the end of the course the student will be able to		**By the end of the program the student will be able to**
S2.1	**Analyse** and interpret the sinusoidal electrical quantities and parameters for 1- phase/3-phase AC circuits	S2	Apply the fundamentals and theories of electrical engineering to solve and analyse electrical systems of limited size using efficient and effective solutions and analysis methods.
S2.2	**Apply** Laplace transform in analysis of electric circuits		
S2.3	**Determine** circuit frequency response of a linear networks		

Table 6: Align PLOs to CLOs for "Electric Circuit Analysis" Course

3.2. Distributing CLOs to Weakly Course Topics and Corresponding Assessment Tools

The CLOs were distributed to the following assessment tools used in the course:
Midterm exams (2): Assessed knowledge and understanding of fundamental circuit analysis concepts.

Assignments: Assessed application of circuit analysis techniques to solve problems and analyse circuits.

Quizzes: Assessed knowledge of specific circuit components and their behavior.

Final exam: Assessed comprehensive understanding of all course topics and the ability to apply knowledge to solve complex problems.

Program: Electrical Engineering	**Course code:7414, Credit Hrs.3, No. of Week:15**	**Year-4, Semester-7, Section-74XX**
Week No./Topics	**Assessment Methods**	**Course learning outcomes (CLOs)**
W-1: TOP-1	Assignment, Midterm1, Final Exam	K3.1, S2.1
W-2-3: TOP-2	Assignment, Midterm1, Final Exam	S2.2
W 4-6: TOP-3, TOP-4	Midterm1, Quiz, Final Exam	K3.2, S2.2
W 7-8: TOP-5	Assignment, Midterm1	S2.2, S2.3
W 9-10: TOP-6, TOP-7	Midterm2, Final Exam	K3.1, S2.3
W 11-13: TOP-8, TOP-9	Assignment, Midterm2, Final Exam	K3.1, K3.2, S2.1, S2.2
W 14-15: TOP-10	Assignment, Quiz, Midterm2	K3.1, S2.1, S2.3

Table 7: Course A topics with CLOs assigned to each assessment tool.

3.3. Calculating Numerical Weights for CLOs

Each CLO was assigned a numerical weight based on its frequency of assessment and the weightage of the corresponding assessment tools in the course's overall grading scheme. For example, a CLO assessed in both midterm exams and the final exam would have a higher weight than a CLO assessed only in one quiz.

Program: Electrical Engineering	Course code:7414, Credit Hrs.3, No. of Week:15	Year-4, Semester-7, Section-74XX
Assessment Tools	Course Learning Outcomes (CLOs)	Total frequency counts of CLOs in All assessment tools
Midterm1	K3.1 S2.1 S2.2	3 4 5
Midterm2	K3.2 S2.2 S2.3	3 5 3
Quizzes	S2.1 S2.2 S2.3	4 5 3
Assignment	K3.1 K3.2 S2.1 S2.2	3 3 4 5
Final Exam	K3.1 K3.2 S2.1 S2.2 S2.3	3 3 4 5 3

Table 8: Mapping Assessment Tools to CLOs with CLOs Frequency Count

Consider Midterm 2 in Table 5, this assessment method consists of K3.2, S2.2, and S2.3.
From equation (2)

Total sum of CLOs frequencies in Midterm2=frequency (K3.2) +frequency (S2.2) +frequency (S2.3) = 11

$$\% \, PCLO_{K3.2} = \frac{CLOfrequency}{SumofCLOsfrequencies} = \frac{3}{11} = 27.27\%$$

$$\% \, PCLO_{S2.2} = \frac{CLOfrequency}{SumofCLOsfrequencies} = \frac{5}{11} = 45.45\%$$

$$\% \, PCLO_{S2.3} = \frac{CLOfrequency}{SumofCLOsfrequencies} = \frac{3}{11} = 27.27\%$$

Therefore their weight are calculated as,

$$W_{K3.2} = \frac{PCLO_{K3.2} = (27.27\%)}{100} \times N(=15) = 4.$$

$$W_{S2.2} = \frac{PCLO_{S2.2} = (45.45\%)}{100} \times N(=15) = 7.$$

$$W_{S2.3} = \frac{PCLO_{S2.3} = (27.27\%)}{100} \times N(=15) = 4.$$

3.4. Determining the Percentage of Achievement for Each CLO

Student performance on each assessment tool was evaluated, and the weighted scores for each CLO were calculated and summed up. The percentage of achievement for each CLO was then determined by dividing the total weighted score by the maximum possible weighted score and multiplying by 100.

Suppose a few three students, their marks in the Midterm2 of "Electric circuit analysis course" were tabulated as below.

Therefore, from equation (3) we can calculate the percentage of achievement for each CLO as

$$Achv.(K3.2) = \frac{M_{s_1=2} + M_{s_2=3} + M_{s_3=2}}{r = 3 \times W_n = 4} \times 100 = 58.3\%,$$

$$Achv.(S2.2) = \frac{M_{s_1=5} + M_{s_2=6} + M_{s_3=4}}{r = 3 \times W_n = 7} \times 100 = 71.43\%,$$

$$Achv.(S2.3) = \frac{M_{s_1=2} + M_{s_2=3} + M_{s_3=4}}{r = 3 \times W_n = 4} \times 100 = 75\%.$$

Midterm2	**Course learning outcome corresponding to Midterm2**			
CLOs	**K3.2**	**S2.2**	**S2.3**	Total
Calculated weight	$W_{K3.2} = 4.09$	$W_{S2.2} = 6.82$	$W_{S2.3} = 4.09$	**15**
Student -1 Mark obtained	2	5	2	9
Student -2 Mark obtained	3	6	3	12
Student -3 Mark obtained	2	4	4	10
Total	7	15	9	
Achievement	**57%**	**73%**	**73%**	

Table 9: Marks Obtained by a Sample of Three Students with Its Intended Learning Outcomes Numerical Weights

3.5. Comparing Actual Achievement with Target and Benchmark Values

Target and benchmark values were established for each CLO based on program goals and expectations. The actual achievement percentages for each CLO were then compared to these values. This comparison revealed that students generally performed well in terms of analysis and problem-solving tasks but struggled with knowledge and understanding of fundamental concepts. Consider results obtained from Midterm2 as assessment method described for a sample of three student as in Table 8 above.

$$Achivement\ (Actual\ value) = \frac{Ach.(K3.2) + Achv.(S2.2) + Ach.(S2.3)}{3}$$

$$Achivement\ (Actual\ value) = \frac{57 + 73 + 73}{3} = 67.7\%$$

The procedure was repeated for each assessment tool used to assess the CLOs for 'Electric Circuit Analysis Course', the comparison was conducted, and the points of weakness were identified based on actual values obtained. Based on the Table 9. below the improvement opportunities were recommended, and the improvement process were setting and traced. Table10 illustrates the

Program: Electrical Engineering	Course code:7414, Credit Hrs.3, No. of Week:15	Year-4, Semester-7, Section-74XX
Target Value	Benchmark Value	Actual Value
75%	72%	67.7%

Table 10: CLOs Achievement, Benchmark, and Target Values for "Electric Circuit Analysis Course"-Midterm2

3.6. Data Analysis

The data collected from the assessment tools was analyzed to identify areas where students excelled or struggled. This analysis informed the development of strategies for improvement, such as:

Modifying teaching methods to better address challenging topics.

Providing additional support and resources for students.

Revising assessment tools to ensure alignment with CLOs and appropriate difficulty levels.

Table 10 and Figures 1 - 4 illustrates the computed weights allocated to the course learning outcomes for the "Electric Circuit Analysis" course, evaluated across five assessment tools: Midterm-1, Midterm-2, Assignment, Quizzes, and the Final Exam. It also delineates the attainment percentages attributed to each course learning outcome per assessment tool. These data are then consolidated to ascertain the overall achievement percentage of the learning outcomes. This in-depth analysis facilitates the identification of areas requiring improvement and offers insights for enhancing future student performance evaluations.

4. Discussion

The proposed method for aligning PLOs and CLOs and calculating their numerical weights provides a systematic and transparent approach for directly assessing student learning outcomes in the Electrical Engineering program at the Al Neelain University. The application of this method to the "Electric Circuits Analysis" course yielded valuable insights into student achievement and areas for improvement.

4.1. Strengths of the Method

Alignment: The mapping of CLOs to PLOs ensures that each course contributes directly to the program's overall learning goals. This alignment helps to ensure that the curriculum is focused and that students are acquiring the necessary knowledge and skills for success in their chosen field.

Transparency: The use of numerical weights provides a clear and transparent way to assess the relative importance of each CLO and its contribution to the overall program learning outcomes. This transparency can be beneficial for both students and instructors, as it clarifies expectations and allows for more targeted feedback and improvement efforts.

Data Driven Decision Making: The data collected through this assessment process can be used to identify areas where students are struggling and to develop targeted interventions and support mechanisms. This data can also inform curriculum revisions and teaching strategies, ensuring that the program is responsive to student needs and continuously improving.

Accreditation Support: The transparent and data-driven assessment process aligns with ABET requirements and strengthens the program's casefor accreditation. By demonstrating a commitment to assessing and improving student learning outcomes, the program can showcase its quality and commitment to excellence.

Assessment Tools	M1 -Exam			M2-Exam			Assignment				Quizzes			Final Exam				
Intended Total Mark	15			15			10				10			50				
Course Learning Outcomes (CLOs)	K3.1	S2.1	S2.2	K3.2	S2.2	S2.3	K3.1	K3.2	S2.1	S2.2	S2.1	S2.2	S2.3	K3.1	K3.2	S2.1	S2.2	S2.3
CLOs Frequency in overall assessment tools	3	4	5	3	5	3	3	3	4	5	4	5	3	3	3	4	5	3
Sum of frequency	12			11			15				12			18				
PCLOs frequency % according to each assessment tool	0.25	0.33	0.42	0.27	0.45	0.27	0.2	0.2	0.27	0.33	0.33	0.42	0.25	0.17	0.17	0.22	0.28	0.17
Estimated CLOs weight	3.75	5	6.25	4.09	6.82	4.09	2	2	2.67	3.33	3.33	4.17	2.5	8.33	8.33	11.1	13.9	8.33
student -1 Mark obtained	2	4	4.5	2	5	2	1.5	2	2	0.5	2	1.5	1	6.5	5	9.5	12	7
student -2 Mark obtained	3	3	5	3	6	3	0.75	1.5	1	2.5	2.75	3	2	7	7.5	10	10.5	6
student -3 Mark obtained	1.5	3.5	6	2	4	4	1.8	0.5	1.65	2.8	1	3.5	2.2	5	4.8	9.5	9	8
Achievement of each CLOs in every assessment tool	58%	70%	83%	57%	73%	73%	68%	67%	58%	58%	58%	64%	69%	74%	69%	87%	76%	84%
Total CLOs achievement in each assessment tool	70%			68%			63%				64%			78%				
Overall CLOs achievement in "Electric circuits analysis Course"	68%																	

Table 11: Weight Calculation for Each Assessment Methods and Percentage Achievement

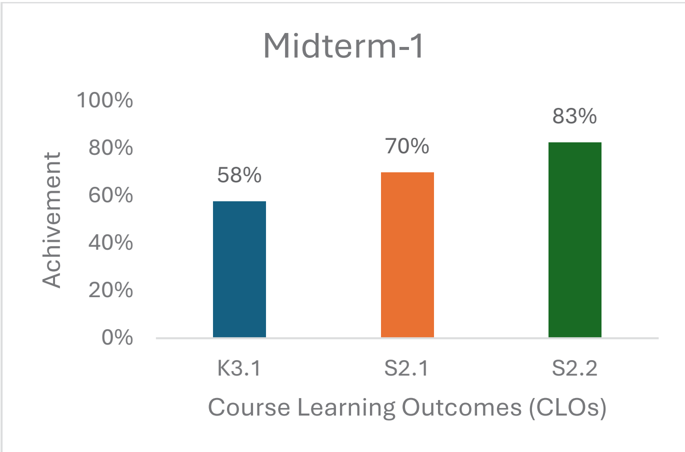

Figure 1: CLOs achievement in "Electric circuits analysis"Midterm1

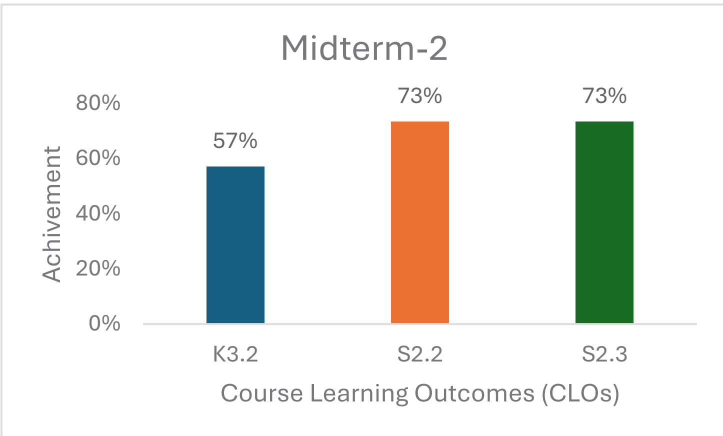

Figure 2: CLOs achievement in "Electric circuits analysis"Midterm2

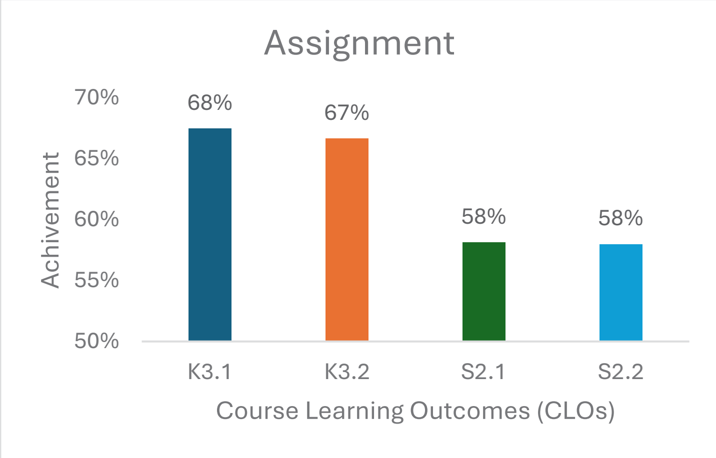

Figure 3: CLOs achievement in "Electric circuits analysis “Assignment

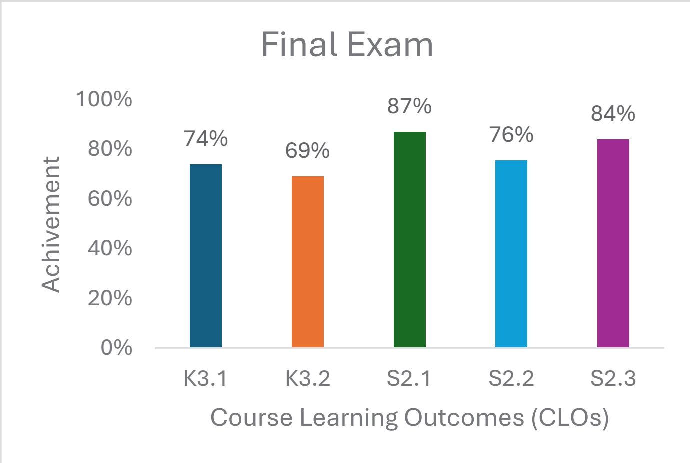

Figure 4: CLOs achievement in "Electric circuits analysis “Final Exam

5. Limitations and Future Research

This study focused on a single course within the Electrical Engineering program. Further research is needed to apply the proposed method to other courses and programs and to evaluate its long-term impact on student learning outcomes. Additionally, future research could explore the integration of indirect assessment methods to provide a more holistic understanding of student learning and program effectiveness.

5.1. Implications for Practice

The findings of this study suggest that the proposed method can be a valuable tool for engineering programs seeking to improve their assessment practices and achieve accreditation. By aligning PLOs and CLOs, calculating numerical weights, and using data to inform decision making, programs can ensure that their graduates are well-prepared for their future careers.

6. Conclusion

This paper presented a method for aligning PLOs and CLOs and calculating their numerical weights for direct assessment in the Electrical Engineering program at the Al Neelain University. This approach provides a valuable tool for measuring student achievement, improving program effectiveness, and supporting accreditation efforts. Future research could involve applying this method to other engineering programs and exploring its impact on student learning and program outcomes.

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