جامعة المستقبل
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أول جامعة أهلية بمنطقة القصيم

Learning Outcomes Assessment Manual

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Chapter I

Introduction

The learning process has learning outcomes and objectives, and it is very important for the educational institution to define learning outcomes and learning objectives for its academic programs and courses, and to propose measurement methods that assess the level of achievement of those outcomes according to a flexible and applicable measurement plan. There are expected gains and problems for learning outcomes.

1.1 Definition of Learning Objectives

The objective of a unit or program is a specific statement of the purpose of education, i.e. it refers to one of the specific areas of learning (knowledge/skill/value) that the teacher intends to introduce the student to.

Examples of goals:

1. Providing students with in-depth knowledge of the performance characteristics of induction motors.

2. Providing students with information about the concept of energy conservation

4. Introducing students to the different styles of pre-Islamic poetry.

1.2 Definition of Learning Outcomes

- Learning outcomes are statements that specify what learners will know or be able to do as a result of a learning activity. Outcomes are usually expressed as knowledge, skills or attitudes. (American Law Libraries Association).
- Learning outcomes are a clear description of what the learner should know, understand and be able to do as a result of learning. (Institute of Learning and Teaching, Sheffield Hallam University)
- Learning outcomes are specific statements of what students should know and be able to do as a result of learning (Morse and Murray, 2005).
- Learning outcomes are statements of what a student is expected to be able to do as a result of a learning activity.... (Jenkins and Unwin).
- Learning outcomes are explicit statements of what we want our students to know, understand, or be able to do as a result of completing courses. (University of New South Wales, Australia).
- Learning outcomes are statements of what the student possesses, acquires and/or is able to demonstrate after completing the course/learning activity
- The learning activity can be, for example, a lecture, a module or an entire program.
- Learning outcomes should not be a “wish or promise” list of what the student can do when the learning activity is completed.
- Learning outcomes must be simple and clear.
- Learning outcomes must be assessable and assessable, meaning they can be measured.

Chapter II

Plans for Measuring Program Learning Outcomes

2.1 Tools for measuring learning outcomes

Measuring tools are classified into direct and indirect tools. Direct tools are opinion-free tools and rely on documented student work, while indirect tools are opinion-based tools, whether the opinion of students, professors, or other relevant parties.

2.1.1 Direct Tools

Include:

- Student work: course tests, tests, course assignments

- Senior Design Project report and student presentations.

– Field training

- Senior Exit Exam to measure the learning outcomes

2.1.2 Indirect tools

Include:

– Course surveys

- Alumni opinion polls

– Employer opinion polls

- Questionnaires for training site supervisors

– Reports of professional advisory committees

- Reports of student advisory committees

– Independent opinion reports, etc

2.2 Assessment and Evaluation of the PLOs Achievement

2.2.1 Steps to conduct the evaluation

Systematic assessment of student learning involves a series of discrete steps. This section provides an overview of each step. The systematic approach to evaluation consists of the following six steps:

1. Formulate a comprehensive, meaningful, and measurable set of program learning outcomes (program learning outcomes).

2. Explain how the curriculum supports the program learning outcomes.

3. Develop a plan to systematically collect evidence of student achievement of the program learning outcomes.

4. Collect, analyze and interpret evidence.

5. Use the resulting information to develop recommendations for improving student learning (including revising curriculum, teaching methods, and advising) and/or reviewing and improving program learning outcomes and assessment methods.

6. Implementation of recommendations.

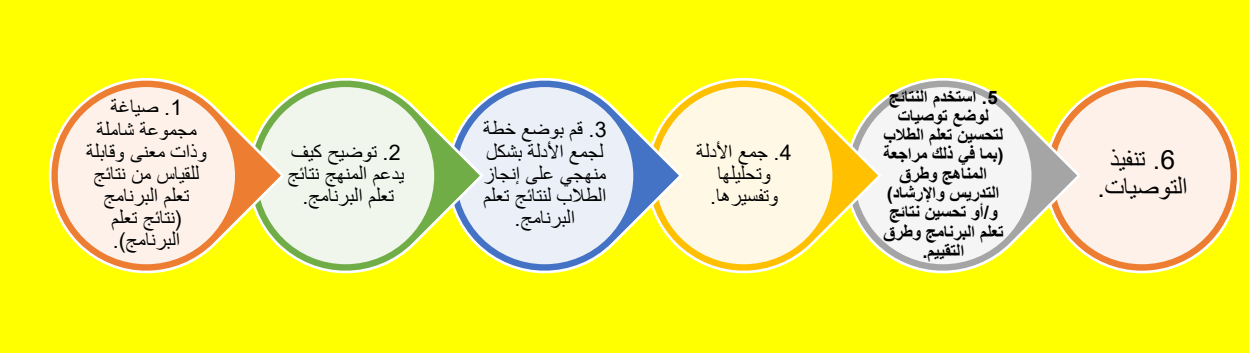

Figure 2.1: Steps for evaluating learning outcomes

2.3 Plans for Measuring and Evaluating Program Outcomes

The success of any academic program in achieving its educational outcomes, as well as the process of continuous improvement of the program, depends on measuring and evaluating the level of its students' acquisition of its educational outcomes. This requires developing a measurement plan for those outputs. When developing a measurement plan, the following rules must be taken into account:

- The plan achieves measurement of all program learning outcomes in a time period that is compatible with the program's time period (every two years, for example).
- The plan ensures that all program learning outcomes are measured once at least every two years (according to the requirement of NCAAA).
- The plan should lead to accurate results while not exhausting faculty members during implementation.
- The plan achieves a correct and strong link between the program's courses and the program's learning outcomes.
- The plan should take into account use of direct and indirect tools in measurement, and include how to link them.
- The plan should set clear thresholds for evaluating results.
- The plan should explain how to document the results.

2.3.1 Proposed Plans for Bachelor's Degree Programs

Several proposals exist in this regard, and the appropriate plan is selected based on the academic level, the nature and specialization of the program, and the number of students enrolled.

A) The First Plan

Main Outline of the Plan

• The level of course alignment with program learning outcomes is determined as either Introductory (I), Practical (P), Mastery (M), or Unrelated, depending on the course's relevance to the level at which it is offered. The following criteria can then be used by program committees to select courses for assessing outcomes:

• Since outcomes reflect what students can demonstrate, understand, and perform, selected courses should have a high relevance (M) or (P).

• Selecting courses that cover multiple outcomes will make the workload for program faculty manageable.

• Courses offered to students at higher levels and capstone courses, such as the graduation project and field training (if applicable), are suitable for assessing program learning outcomes.

• The program's learning outcomes are divided over a four-year period, with the outcomes of each year being measured so that all outcomes are assessed over the four years for a given cohort.

• A senior exit exam is administered at the end of the assessment cycle and is used with a specific weight alongside other tools to measure learning outcomes.

• The cycle is repeated every two years for subsequent cohorts of students.

• Direct assessment is accompanied by indirect assessment.

B) The Second Plan

Main Outline of the Plan

• The level of course alignment with program learning outcomes is determined as either introductory (I), practice (P), mastery (M), or unrelated, depending on the course's relevance to the level at which it is offered. The following criteria can then be used by program committees to select courses for outcome assessment:

• Courses at the introductory and intermediate levels are selected for formative assessment of program learning outcomes. This allows program committees to address any shortcomings that may arise in these outcomes.

• Since learning outcomes reflect what students can demonstrate, understand, and perform by graduation, assessment should be summative. This means selecting courses from the upper levels of the program and ensuring a P or M correlation between the selected courses and the PLOs.

• Courses offered to students at the upper levels, along with capstone courses such as the graduation project and field training (if applicable), are more suitable for summative assessment of program learning outcomes, alongside graduation courses in the final semesters.

• Assessment is conducted for a specific cohort.

• A Senior Exit Exam is administered at the end of the assessment cycle and is used with a specific weight alongside other tools to measure outcomes.

• Assessment is repeated for successive cycles every two years for other cohorts of students.

• Direct assessment is accompanied by indirect assessment.

C) The Third Plan

This plan is suitable for programs that present educational material in the form of integrated and customized learning units, such as medical programs and some health science programs. Main Outlines of the Plan

• The learning outcomes of each learning unit are defined and then linked to the program's learning outcomes as either Introductory (I), Practice (P), Mastery (M), or Unrelated.

• Formative assessment of learning outcomes is conducted during and throughout the duration of the learning unit, and formative assessment is used for improvement.

• Summative assessment of learning outcomes is conducted using the final exam. Upon graduation, the program's summative learning outcomes are assessed by linking them to the learning outcomes of the group of learning units.

• Direct assessment is accompanied by indirect assessment.

2.3.2 Temporary Plan for Evaluating Program Learning Outcomes

Time may not permit long-term measurement, and a Self-Study Report (SSR) for the program may be urgently required. This report must include an evaluation of the program's learning outcomes assessment results. In this case, a temporary plan may be implemented.

Main Outlines of the Plan

• If results for courses delivered in previous years are unavailable, all learning outcomes (direct and indirect) will be assessed and documented using available courses and surveys, particularly those conducted in the final academic year, with a Senior Exit Exam administered to graduating students.

• The outcomes will be evaluated, and conclusions drawn.

• Based on this evaluation, improvement procedures and/or plans will be developed.

2.4 Evaluation of Program Learning Outcomes

Direct and indirect measurement of output verification is followed by analyzing the results, assessing the level of verification, and then taking the necessary actions and improvement processes.

2.4.1 Direct assessment of program learning outcomes

• Direct assessment of program learning outcomes is conducted through student work during courses using various assessment tools as listed in the course specifications; like:

- Student assignments and reports
- Short tests for students
- Student discussions in the classroom
- Presentations in the classroom
- The Capstone Senior Design Project report and the student presentation

• Tools included in course specifications must be carefully designed in order to be successful in assessing the learning outcomes to which the courses contribute.

• A threshold is set by the program committee for the level of achievement to assume the program learning outcomes have been met.

• The level of achievement for each output is determined using two measures:

- Average AM scores as a percentage not less than the threshold value, which is a vertical scale representing the depth of verification.
- The percentage of students who achieved the threshold, which is a horizontal measure. In order to say that the specified program learning outcomes have been achieved horizontally, at least an acceptable and satisfactory percentage of the students who attended the final exam must obtain a percentage not less than the specified threshold.

2.4.2 Indirect assessment of program learning outcomes

• Indirect formative assessment of the program learning outcomes is conducted through the results of student surveys for courses associated with each of the identified program learning outcomes.

• At the end of each semester, students are measured through a questionnaire to express their opinion on the extent to which the course-related outcomes have been achieved and the good planning and management of the course.

• The program committee should set a threshold for the level of achievement of the program learning outcomes, so that a decision on the achievement of the learning outcomes can be made by calculating the arithmetic mean/median of the students' rating.

- Undergraduate programs determine the formative level of PLOs based on the survey results of the group of program courses linked to the exit in each semester.
- Undergraduate programs measure and evaluate the aggregate level of PLOs at graduation based on the results of the surveys of the program's final year group of courses with the peak courses associated with the exit.
- The questionnaire for students expected to graduate is considered an effective tool to measure and evaluate the cumulative level of PLOs upon graduation
- Stakeholder questionnaires are used to measure and evaluate the program outcomes.

2.5 Recommendations and Improvement Actions

The next stage of the process of analyzing and evaluating learning outcomes results is to use the results to develop recommendations to improve student learning (including reviewing curricula, teaching methods, and advising) and/or improving program learning outcomes and assessment methods. These improvements are proposed by the Program Quality Committee and included in the program's annual operational plan and advancement. To the department council to approve it, and then complete the procedures according to the college and university regulations.

2.6 Method of Calculating the achievement level of the PLOs Through the Direct Measures

As several courses are used to measure the achievement of a learning outcome (PLO1) - and each course has its own credits and maximum grade, this should be taken into consideration as follows:

Assume that the credit hours for the courses are: C1, C2, C3…

The grades assigned to the Output (PLO1) as a percentage of the total course grades are: M1, M2, M3...

The percentages of achievement of this outcome in the three courses are: A1, A2, A3…

The percentage of achieving this outcome (PLO1) is calculated by the following equation:

A_R = (A1xC1xM1+ A2xC2xM2+ A3×C3xM3 + …)/ (C1×M1+ C2xM2+ C3xM3 + …)

2.7 Practical Application of the Direct Measurement of a PLO

2.7.1 Example from an Electrical Engineering Program

Course EE 330 has been linked to the PLOs as shown in the following table:

	CLOs	Aligned-PLOs
1.0	**Knowledge and Understanding:**	

CLOs		Aligned-PLOs
1.1	Recognize construction, connections, principle of operation and modelling of single-phase transformers, three-phase transformers and autotransformers.	K.2
1.2	Recognize and illustrate fundamentals of the ac machines such as the concept of the rotating flux, the induced voltage and torque.	K.2
1.3	Recall construction, principle of operation, modeling of the synchronous generator.	K.2
1.4	Determine the synchronization process of the alternators.	K.2
1.5	Recall construction, principle of operation and modeling of synchronous motor.	K.2
1.6	State the starting methods of synchronous motors.	K.2
2.0	**Skills:**	
2.1	Able to determine and analyze the transformers, synchronous generator and synchronous motor performance characteristics.	S.2
2.2	Able to choose the suitable control method of the synchronous machines.	S.2
2.3	Understand and able to troubleshoot the technical problems associated with electrical machines in electrical power systems.	S.2
2.0	**Values:**	
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According to the course specification, the CLOs of the course will be measured as follows:

Code	Course Learning Outcomes	Assessment Methods
1.0		
1.1	Recognize construction, connections, principle of operation and modelling of single-phase transformers, three-phase transformers and autotransformers.	• Assessments of reports, homework and assignments • Five planed quizzes • Two midterms exams • Final exam
1.2	Recognize and illustrate fundamentals of the ac machines such as the concept of the rotating flux, the induced voltage and torque.	
1.3	Recall construction, principle of operation, modeling of the synchronous generator.	
1.4	Illustrate the synchronization process of the alternators.	
1.5	Recall construction, principle of operation and modeling of synchronous motor.	
1.6	State the starting methods of synchronous motors.	
2.0		
2.1	Able to determine and analyze the transformers, synchronous generator and synchronous motor performance characteristics.	• Assessments of reports, homework and assignments • Five planed quizzes • Two midterms exams • Final exam
2.2	Able to choose the suitable control method of the synchronous machines.	
2.3	Understand and able to troubleshoot the technical problems associated with electrical machines in electrical power systems.	
3.0		
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Course information and tests are as follows:

- The number of credit hours for EE 330 (C1) is 3 hours
- A short exam (quiz) was designed to measure the course learning outcomes (1.1 & 1.2), and the average score of students was 8.7 out of 10, noting that the weight of the quiz is two marks.
- In the second semester exam, parts of questions related to the course learning outcomes (1.3& 1.4) were set, and their total maximum score was 4 marks, and the average score for students' answers was 3.81.
- In the final test, parts of questions were set about the course learning outcomes (1.3-1.6), and their total maximum score was 6 marks, and the average score for students' answers was 5.32 out of 6 marks.

Accordingly, the measurement of achieving the K.2 (A1) output is as follows:

A1 = (8.7/10x100x0.02 + 3.81/4x100x0.16+ 5.52/6x100x0.60)/(0.02+0.16+0.60) = 89.9

- The grades assigned to Director K.2 are (2 + 4 + 6), i.e. 12 grades, and therefore the ratio of the exit grade to the total grade (M1) is 100/12, i.e. 0.12.

Assuming that the program linked 3 other courses to measure the learning outcome K.2 - according to the matrix linking the courses to the program learning outcomes - the information related to those courses could be summarized as shown in the following table:

Course	C1	Full Mark	Assigned Marks	M	A	Notes
EE 201 Electrical Circuits	3	100	14	0.14	88.00%	--
EE 330	3	100	12	0.12	89.97%	--
EE 432	3	100	10	0.10	87.91%	--
Senior Design Project	5	200	14	0.07	91.22%	EE 491 and EE 492

Based on this information, the percentage of achievement of learning outcome K.2 based on the courses can be calculated as follows:

A_{CR} = (88.00x3x0.14 + 89.97x3x0.12 + 87.91x3x0.10 + 91.22x5x0.07)/(3x0.14 + 3x0.12 + 3x0.10 + 5x0.07)

= 89.26

From the results of the "Senior Exit Exam" test for graduate students, the average student results for the questions related to Exit K.2 was 80.1%. Taking into account that the weight of this test is 0.3 and the weight of the courses is 0.70, the final result for achieving Exit K.2 is calculated as follows:

A_R = (89.26x0.7 + 80.10x0.3)/(0.7 + 0.3) = 86.51

For further clarification, Appendix A shows the parts of the questions related to the course learning outcomes and related to the program learning outcome K.2.

2.8 Practical Application for the Indirect Measure of a PLO

Indirect measurement gives the opportunity to seek the opinion of stakeholders in determining the program's performance, including measuring the program's learning outcomes.

This evaluation is based mainly on questionnaires to survey stakeholders such as students, graduates, and employers.

It is necessary to analyze and evaluate the results of the questionnaires in the same way as the evaluation method using direct methods, so that each method can support the other.

2.8.1 Example from an Engineering Program

The results of the surveys for items related to learning outcomes K.2, S.4 and V.2 can be summarized in the following table:

Outcome	Item(s) result*				Assessment of the level outcome achievement
	Students Survey (program Quality) PO_SU_0	Field training Supervisors Survey PO_FTR_SUP	Alumni survey PO_GRAD	Employers survey PO_EMPO	
K.2	4.2 out of 5.0	4.3 out of 5.0	----	4.2 out of 5.0	4.23 out of 5.0
S.4	4.3 out of 5.0	---	---	4.1 out of 5.0	4.2 out of 5.0
V.2	5.0 من 3.9	4.0 out of 5.0	---	4.1 out of 5.0	4.0 out of 5.0

* Respondents' average rating of the item(s) associated with the outcome

Appendix B shows the items associated with Outputs k.2, S.4 and V.2 in the questionnaires used.

2.9 Evaluating the Direct and Indirect Achievements of the Outcomes

The results are evaluated in light of the specified thresholds and assessment trends over the past years, and comparing the boys' section to the girls' section, if applicable.

Regarding direct measurement, the previous Engineering program has set 70% as the threshold for achieving the learning outcomes, and since the percentage of achieving the K.2 output calculated in 3.7.1 is 86.51%, this indicates that the outcome has been achieved through direct measurement, and by referring to the questionnaires of the relevant parties, we find that the outcome has been achieved. With a rate of 4.23 according to the table given in 3.8.1, and since

the threshold specified in this regard by the Bachelor of Electrical Engineering program is 3.75, the result of the indirect measurement supported the result of the direct measurement.

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Appendix A: Question Parts Related to K.2

The parts highlighted in yellow are these related to program learning outcome K.2

[redacted] **EE 330**

College of Engineering **2nd Quiz**

EE Department [redacted]

NAME: **ID NO.:**

Answer the following questions **Time allowed: 15 mins**

a) State the conditions of electromechanical energy conversion for electrical machines.

b) False or True:

i- A machine having a rotor of 4 poles and a stator of 6 poles produces a uniform torque ( )

ii- A machine having a rotor of 4 poles and a stator of 6 poles produces a pulsating torque only ( )

iii- Two rotating flux waves produces an instantaneous torque only if they have the same speed ( )

[redacted]

EE 330

College of Engineering

First Mid-Term Exam

EE Department

[redacted]

NAME:

ID NO.:

Answer all questions

Time allowed: 75 mins

Q.1 –a) State 4 types of the transformers as regarding the transformer function.

–b) state the assumptions for the transformer to be considered as an ideal one.

–c) A single-phase power system consists of a 220 V, 60 Hz generator supplying a load of impedance $2.9\angle 30^{o}$ ohm through a transmission line of impedance 0.08 + j 0.11 ohm.

i. Calculate the load voltage, supply current and power-factor, and the line power losses.
ii. Suppose a step up transformer of turns ratio 1:30 is placed at the generator end and a 30:1 step down transformer is placed at the load end, calculate the load voltage, generator current and power-factor, and the line power losses in this case.

Q.2- a) Prove, using voltage phasor diagram, that the transformer has a positive voltage regulation when it delivers a lagging power factor current.

- b) A 10-kVA, 8000/230-V distribution transformer has a series impedance referred to the primary side of 80 + j 350 ohm. The components of the excitation branch are R_C = 550 k- ohm and X_M = 60 k-ohm.

i. Using the accurate calculations, calculate the voltage regulation of the transformer at full-load 0.85 leading power factor.
ii. Calculate the transformer efficiency at the condition of (i).
iii. What is the transformer power factor at which the transformer voltage regulation has a zero value?
iv. What is the transformer P.F at which the full-load voltage regulation has a minimum value?

Appendix B: Surveys' Items Related to the Concerned Learning Outcomes

Outcome K.2

Survey	Item(s)	Notes
Students Survey (program Quality)	لقد طورت المعارف والمهارات اللازمة لمهنتي التي اخترتها.	
Field Training Supervisors Survey	• Possess adequate scientific background	
Alumni survey	-----	
Employers survey	• يمتلك الخريج مهارات الفهم والاستيعاب	

Outcome S.4

Survey	Item(s)	Notes
Students Survey (program Quality)	• لقد حسن البرنامج مهاراتي في الاتصال.	
Field Training Supervisors Survey	----	
Alumni survey	-----	
Employers survey	• خريج لديه مهارات لغة إنجليزية جيدة (في حال طلبها في العمل • يمتلك الخريج مهارات المحادثة والتواصل الشفهي في العمل	

Outcome V.2

Survey	Item(s)	Notes
Students Survey (program Quality)	• لقد ساعدني البرنامج في تطوير الاهتمام الكافي لدي للسعي في الاستمرار في تحديث معلوماتي حسبما يستجد في مجال دراستي.	
Field Training Supervisors Survey	• Has the ability for learning and searching	
Alumni survey	-----	
Employers survey	• يمتلك الخريج القدرة على التكيف مع التكنولوجيا الحديثة	