Student Outcomes Assessment Process[1]

Our assessment process is organized along four dimensions, shown in Figure 4-1. These dimensions are:

1. **Performance Indicators** – these are key performance measurements designed to understand the attainment of student outcomes.
2. **Target Instruments** – these refer to the instruments from which data will be collected to measure the performance indicators.
3. **Assessment Cycle** – this is the cycle that specifies the schedule for data collection on performance indicators, outcome assessment, and evaluation.
4. **Evaluation & Actions** – these are the activities that the CSE Department will take to improve the Software Engineering (SWE) program, based on the assessment process. The result shall be corrective actions on curriculum, teaching activities, course content, and other elements that help attain student outcomes.

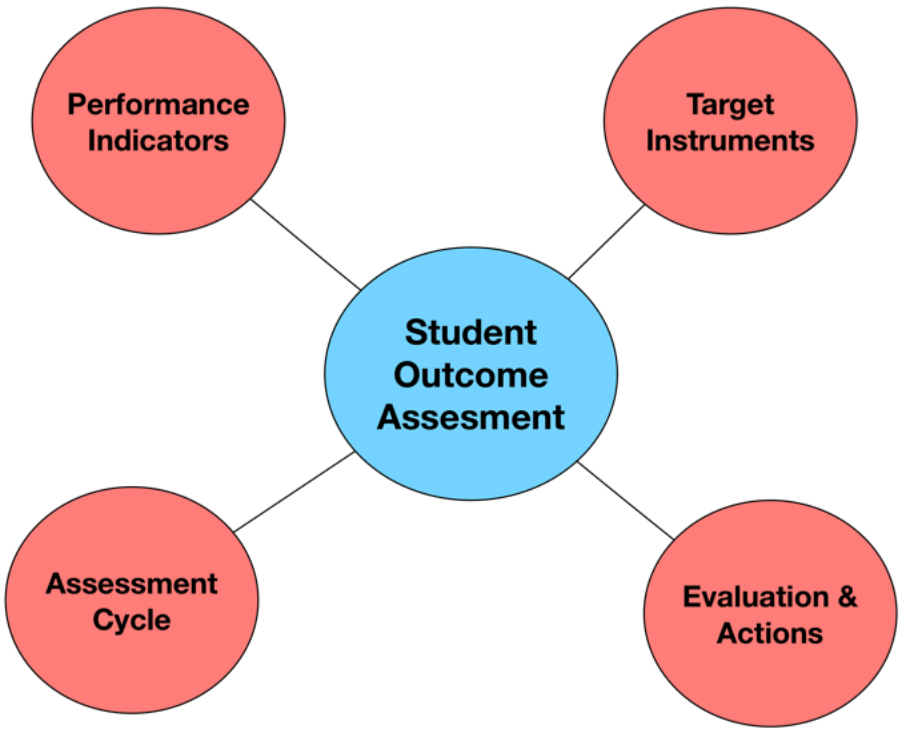

Figure 4-1: Student Outcome Assessment Components

We now describe these elements in more detail.

[1] An initial version of this document was done during Fall 2022.

Performance Indicators

We have defined a set of performance indicators that serve as key measurements designed to understand the attainment of student outcomes. These performance indicators are designed to be applicable to different assessment instruments such as course portfolios, student portfolios, graduation surveys, or employer surveys.

Table 1 shows the current set of performance indicators for the eight groups of the SWE SOs.

Table 1: Student Outcomes and their Performance Indicators

Group	SOs Included	Key Description	Performance Indicator
1	E1	Complex Problem Solving	1. The student can formulate a clear problem statement. 2. The student can identify a proper solution strategy for a given problem. 3. The student can justify the feasibility of the solution within given constraints.
2	E2	Design & Implement	1. The student provides a design that complies with requirements, and professional standards or best practices. 2. The student selects appropriate tools and methodologies that are well justified. 3. The student implements a solution and shows compliance with requirements.
3	E3	Effective Communication	**1.** The student can write about a technical topic in a clear and organized manner. **2.** The student presents a technical topic to an audience in a clear, concise, and understandable manner. **3.** The student can understand questions from an audience and address them correctly.
4	E4	Professional & Ethical Issues	**1.** The student recognizes the role of professional ethics, as specified in the ACM Code of Ethics, the IEEE Computer Society Code of Ethics, or another well-established professional source. **2.** The student properly identifies important legal and ethical issues involved within a professional situation. **3.** The student makes an informed judgment considering its trade-offs, impacts and consequences on relevant global, economic, environmental, and societal contexts.

Group	SOs Included	Key Description	Performance Indicator
5	E5	Teamwork	**1.** The student fulfills all assigned responsibilities to ensure team success. **2.** The student contributes to the decision-making process to effectively meet project goals. **3.** The student maintains continuous and effective communication to achieve project goals.
7	E6	Experimentation	**1.** The student designs and conducts experiments or processes to collect data that is relevant to solve a problem. **2.** The student can properly process, analyze, and interpret experimental data. **3.** The student uses engineering judgment to derive conclusions from experimental data.
8	E7	Self-learning	**1.** The student recognizes the need to acquire additional knowledge to solve a problem. **2.** The student acquires additional knowledge when required to solve a problem, using appropriate learning strategies. **3.** The student applies additional acquired knowledge when required to solve a problem.

Note: SOs Group 6 only applies to the CSE program. That's why it is skipped in the above table. We are keeping the group numbering here for consistency with the other program and to facilitate our assessment of both programs.

Target Instruments

So far, we have only defined course portfolios as target instruments for assessment. However, we will continue exploring additional instruments to augment our capabilities to assess the attainment of the SOs from different perspectives. In our current efforts, the course portfolios used for assessment fall into two groups:

1. **Capstone course**: INSO 4151- Senior Project Design
2. **Required upper-level courses**:
    a. CIIC 4050 – Operating Systems
    b. CIIC 4060 – Database Systems
    c. CIIC 4070 – Computer Networks
    d. INSO 4101 – Introduction to Software Engineering
    e. INSO 4115 - Software Engineering Requirements
    f. INSO 4116 - Software Design

g. INSO 4117 - Software Reliability Testing

We focus on these courses because students are more mature, and their skills for problem solving are better developed. Thus, collecting assessment data from these courses shall result in better quality data sets that we can rely upon to understand the attainment of SOs.

Table 2 shows the preliminary mapping between CSE SOs and the courses on which we intend to collect data to assess SO attainment. Each of these courses has specific activities that can be used to measure the attainment of the SO. As mentioned in the previous section, we have only defined performance indicators for a subset of the SOs. Thus, this mapping might be adjusted once we complete the definition of the remaining performance indicators.

Table 2: Mapping SOs assessment to course portfolios.

Course	Student Outcome Assessment Per Course						
	E1	E2	E3	E4	E5	E6	E7
CIIC 4050 - Operating Systems				X			
CIIC 4060 - Database Systems			X		X		X
CIIC 4070 - Computer Networks	X					X	
INSO 4101 - Introduction to Software Engineering		X					
INSO 4115 - Software Engineering Requirements				X			
INSO 4116 - Software Design		X					
INSO 4117 - Software Reliability Testing							X
INSO 4151 – SWE Capstone	X	X	X	X	X	X	X

Rubrics

To have uniformity in the assessment of each student outcome across different instruments, courses, or assessment activities, we have established a set of performance indicators (PIs) and rubrics for each SO. For a particular SO, its PIs and rubrics shall be used in any activity in which assessment of the SO is done.

A performance indicator for a particular SO establishes accomplishments that can be measured and that are expected to represent a reliable mechanism to determine the attainment of that SO. For each rubric we have defined a scoring system that captures the level of attainment in each SO. Table 3 shows this scoring system.

Table 3: Rubrics Scoring System

Level	Score	Brief General Description as to When Applies[4]
Unsatisfactory	1	The work done by the student has many serious deficiencies, indicating that it is inadequate.

Developing	2	The work done by the student shows some potential but still has a few major deficiencies.
Satisfactory	3	The work done by the student can be improved but is reasonable and satisfies minimum requirements.
Exemplary	4	The work done by the student shows complete mastery of appropriate skills.

Assessment of a Performance Indicator in each Course

For the assessment of a particular SO in a particular course, different activities can be used to measure the performance on the different PIs that have been established for that SO. For such activity, the grader will know what performance indicator is that activity being used to measure. Therefore, he or she will assign a grade that matches one of the rubrics depending on the criteria established to grade the work done by the student. Finally, the score (1, 2, 3, or 4) corresponding to that rubric will be assigned as the final score on the activity. If several activities in a course are used to measure the same PI on the same SO, then, for a given student, his/her level of performance on that PI is computed as the average of the scores obtained on all those activities.

When a course is under assessment, it is expected that the professors in charge define how the applicable performance indicators will be measured and evaluated. That effort will be done in conjunction with the CAIC. If there are several professors in charge of multiple sections of the course, it is expected that they coordinate this effort, so that all sections use the same assessment instruments.

The assessment instruments are activities that are part of the work used in the course to determine the final grade of the students. Such activities in a particular course are expected to be aligned to the specific topics of the course, as well as with its specific set of course learning outcomes (CLOs). For example, they could be:

1. Quizzes
2. Specific exercises in exams
3. Homeworks
4. Projects
5. Laboratory work
6. Written reports
7. Oral presentations
8. Surveys

Assessment in Capstone Courses

In the case of the capstone course, there are no CLOs per se. Instead, we measure how the students perform on each of the SOs based on the following activities:

1. Written project proposal
2. Written project reports
3. Oral project presentations
4. Demonstrations of the project artifacts (e.g., mobile app, software tool, web app)

The previous activities may be enhanced or substituted by surveys whenever applicable.

How to Measure Performance of PIs in a Particular Course and Capstone

To measure the **level of performance of a particular PI in a particular course**, we measure the **percentage of passing students who have an average score of 3 or more** among all the activities that were used to assess that PI.

For each PI in a course, we have established an **expected performance of the PI**. We consider that any PI below that performance threshold would be an indication that further assessment would be needed to determine the source of the problem. Corrective actions for improvement would then be decided.

Rubrics and Instruments for the Assessment of SOs Based on Performance Indicators

In this section, we present the following four items for each group of SOs.

1. The SOs in the group.
2. A detailed set of rubrics that have been established to measure each one of the PIs corresponding to the SOs in the group.
3. The list of courses in the curriculum in which skills relevant to the SOs in the group are acquired by the student.
4. The list of courses where the direct assessment of the corresponding PIs is expected to be done, an idea of the type of assessment activities or instruments to be used, and the expected level of performance of each PI on each such instrument.

Croup 1: Student Outcomes E1

E1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;

Table 4 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcomes in Group 1: E1

Table 4: Rubrics for SO E1

Performance Indicators	Score			
	Unsatisfactory	**Developing**	**Satisfactory**	**Exemplary**
PI-1: The student can formulate a clear problem statement.	The student is unable to provide a problem statement	Problem statement contains a general idea but lacks key aspects.	Problem statement is adequate but misses a few aspects.	Problem statement that captures the most relevant details of the underlying problem.
PI-2: The student can identify a proper solution strategy for a given problem.	The student is unable to identify a proper solution strategy to the problem.	The proposed solution contains a general idea but lacks key aspects.	The proposed solution is adequate but misses a few aspects.	The proposed solution complies with the problem statement missing perhaps small details.

Performance Indicators	Score			
	Unsatisfactory	**Developing**	**Satisfactory**	**Exemplary**
PI-3: The student can justify the feasibility of the solution within given constraints.	The student cannot justify the feasibility of the solution.	The solution is not properly justified or fails to meet several key constraints.	The solution is justified but fails on a few key constraints.	The solution is justified and complies with all key constraints.

Skills for SO E1 are developed and practiced in the following courses: CIIC 3075 – *Foundations of Computin*g, CIIC 3081 – *Computer Architecture I*, CIIC 4010 – *Advanced Programming*, CIIC 4025 – *Analysis and Design of Algorithms*, CIIC 4030 – *Programming Languages*, CIIC 4060 – *Database Systems*, CIIC 4070 – *Computer Networks*, CIIC 4082 – *Computer Architecture II*, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 5 shows details about the courses where the assessment of SOs E1 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 5: Assessment strategy for SO E1

Performance Indicators	Where is Direct Assessment Done	Instrument	Target for Performance[2]
PI-1: The student can formulate a clear problem statement.	INSO 4151 (Capstone)	Project's progress report or final report	80%
	CIIC 4070	Project's final report	75%
PI-2: The student can identify a proper solution method for a given problem.	INSO 4151	Project's progress report or final report	80%
	CIIC 4070	Project's Final Report	75%
PI-3: The student can justify the feasibility of the solution within given constraints.	INSO 4151	Project's final report	80%
	CIIC 4070	Project's Final Report	75%

Group 2: Student Outcome E2

[2] The **percentage of passing students who have an average score of 3.5 or more** among all the activities that were used to assess that PI.

E2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;

Table 5 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcomes in Group 2: E2.

Table 6: Rubrics for SO E2

Performance Indicators	Score			
	Unsatisfactory	**Developing**	**Satisfactory**	**Exemplary**
PI-1: The student provides a design that complies with requirements, and professional standards or best practices.	Design statement meets too few of the requirements, and professional standards or best practices.	Design statement fails to meet the majority of the requirements, and professional standards or best practices.	Design statement meets the majority of the requirements, and professional standards or best practices.	Design statement properly complies with requirements, and professional standards or best practices.
PI-2: The student selects appropriate tools and methodologies that are well justified.	The student does not select appropriate tools nor methodologies that are well justified.	The student fails to select appropriate tools or methodologies that are well justified.	The student selects mostly appropriate tools and methodologies that are well justified.	The student selects appropriate tools and methodologies that are well justified.
PI-3: The student implements a solution and shows compliance with requirements.	The student cannot implement a solution.	The student implements an incomplete solution or fails to show compliance with key requirements.	The student implements a solution but does not show compliance with some requirements.	The student implements a solution and shows compliance with requirements.

Skills for Group 2 of SOs are developed and practiced in the following courses: CIIC 3081 – *Computer Architecture I*, CIIC 4010 – *Advanced Programming*, CIIC 4020 – *Data Structures*, CIIC 4025 – *Analysis and Design of Algorithms*, CIIC 4030 – *Programming Languages*, CIIC 4060 – *Database Systems*, CIIC 4070 – *Computer Networks*, CIIC 4082 – *Computer Architecture II*, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 7 shows details about the courses where the assessment of SOs C2 and E2 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 7: Assessment strategy for SO E2

Performance Indicators	Where is Direct Assessment Done	Assessment Instruments	Target for Performance
PI-1: The student provides a design that complies with functional requirements, professional standards and other constraints.	INSO 4151	Project's progress report or final report	80%
	INSO 4101	Course project	75%
	INSO 4116	Course Project	75%
PI-2: The student selects appropriate tools and methodologies that are well justified.	INSO 4151	Project's progress report or final report	80%
	INSO 4101	Course project	75%
	INSO 4116	Course Project	75%
PI-3: The student implements a solution and shows compliance with requirements.	INSO 4151	Project's final report	80%
	INSO 4101	Course project	75%
	INSO 4116	Course Project	75%

Group 3: Student Outcome E3

E3: an ability to communicate effectively with a range of audiences;

Table 8 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcomes in Group 3: E3.

Table 8: Rubrics for SO E3

Performance Indicators	Unsatisfactory	Developing	Satisfactory	Exemplary
PI-1: The student is able to write about a technical topic in a clear and organized manner.	The student's writing lacks organization or clarity.	The student writes with some organization, but key essential parts are missing.	The student writes a clear and well-organized document that is able to convey the message, but a few essential parts are still missing.	The student writes an excellent, well-organized document, clearly conveying all the central ideas for the topic being presented.
PI-2: The student presents a technical topic to an audience in a clear, concise, and understandable manner.	The presentation lacks clarity and appropriate structure.	Some parts of the presentation are clear, but in general it is hard to	The presentation is clear and conveys the message, but it is either not concise	The presentation is clear, concise and the key messages are understandable

		understand the key message.	or misses to communicate a few essential parts.	to the audience.
PI-3: The student is able to understand questions from an audience and address them correctly.	The student cannot understand or properly address any valid questions from the audience.	The student understands just a few valid questions from the audience and is able to answer some of them. Some answers show a weak understanding of the topic.	The student understands most valid questions from the audience and is able to answer most of them albeit with some vagueness in a few cases.	The student shows clear understanding of almost all valid questions from the audience and is able to articulate appropriate and knowledgeable answers.

Skills for Group 3 of SOs are developed and practiced in the following courses: CIIC 3075 – *Foundations of Computing,* CIIC 4030 – *Programming Languages,* CIIC 4060 – *Database Systems,* and INSO 4101 – *Introduction to Software Engineering*.

Table 9 shows details about the courses where the assessment of SO E3 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

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Table 9: Assessment strategy for SO E3

Performance Indicators for C3-E3	Where is Direct Assessment Done	Assessment Instruments	Target for Performance
PI-1: The student is able to write about a technical topic in a clear and organized manner.	INSO 4151	Project proposal, progress report, and final report	80%
	CIIC 4060	Project proposal.	75%
PI-2: The student presents a technical topic to an audience in a clear, concise, and understandable manner.	INSO 4151	Project presentation.	80%
	CIIC 4060	Project presentation.	75%
PI-3: The student is able to understand questions from an audience and address them correctly.	INSO 4151	Project presentation.	80%
	CIIC 4060	Project presentation.	75%

Group 4: Student Outcome E4

E4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;

Table 10 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcomes in Group 4: E4.

Table 10: Rubrics for E4

Performance Indicators	Unsatisfactory	Developing	Satisfactory	Exemplary
PI-1: The student recognizes the role of professional ethics, as specified in the ACM Code of Ethics, the IEEE Computer Society Code of Ethics, or another well-established professional source.	The student fails to recognize the role of ethics in the Computing profession.	The student recognizes some of the ethical aspects in the Computing profession.	The student recognizes most parts of the professional ethics code, missing only a few aspects.	The student recognizes all of the aspects of a professional ethics code.
PI-2: The student properly identifies important legal and ethical issues involved within a professional situation.	The student fails to identify existing legal or ethical issues within a professional situation that must be addressed.	The student identifies some existing legal or ethical issues within a professional situation that must be addressed.	The student identifies most existing legal or ethical issues within a professional situation that must be addressed.	The student identifies all existing legal or ethical issues within a professional situation that must be addressed.
PI-3: The student makes an informed judgment considering its trade-offs, impacts and consequences on relevant global, economic, environmental, and societal contexts.	The student's judgment fails to address any relevant trade-offs, impacts, or consequences.	The student's judgment addresses a few, but misses key, relevant trade-offs, impacts, or consequences.	The student's judgment addresses most relevant trade-offs, impacts, or consequences.	The student's judgment addresses all relevant trade-offs, impacts, or consequences.

Skills for Group 4 of SOs are developed and practiced in the following courses: CIIC 3015 – *Introduction to Computer Programming I,* CIIC 4010 – *Advanced Programming,* CIIC 4050 – *Operating Systems,* CIIC 4070 – *Computer Network*s, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 11 shows details about the courses where the assessment of SO E4 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 11: Assessment strategy for SO E4

Performance Indicators for C4-E4	Where is Direct Assessment Done	Assessment Instruments	Target for Performance

PI-1: The student recognizes the role of professional ethics, as specified in the ACM Code of Ethics, the IEEE Computer Society Code of Ethics, or another well-established professional source.	CIIC 4050	Exam question	75%
	INSO 4115	Course project	75%
PI-2: The student properly identifies important legal and ethical issues involved within a professional situation.	CIIC 4151	Progress reports and final report	80%
	CIIC 4050	Exam question	75%
	INSO 4115	Course project	75%
PI-3: The student makes an informed judgment considering its trade-offs, impacts and consequences on relevant global, economic, environmental, and societal contexts.	CIIC 4151	Progress reports and final report	80%
	CIIC 4050	Exam question	75%
	INSO 4115	Course project	75%

Group 5: Student Outcome E5

E5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;

Table 12 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcomes in Group 5: E5.

Table 12: Rubric for SO E5

Performance Indicators	Score			
	Unsatisfactory	**Developing**	**Satisfactory**	**Exemplary**
PI-1: The student fulfills all assigned responsibilities to assure team success.	The student fulfills too few assigned responsibilities.	The student fulfills some assigned key responsibilities.	The student fulfills most of the assigned key responsibilities	The student fulfills all assigned responsibilities to assure team success
PI-2: The student contributes to the decision-making process to effectively meet project goals.	The student rarely contributes to the decision-making process.	The student occasionally contributes to the decision-making process.	The student regularly contributes to the decision-making process.	The student constantly and substantially contributes to the decision-making process.

Performance Indicators	Score			
	Unsatisfactory	**Developing**	**Satisfactory**	**Exemplary**
PI-3: The student maintains continuous and effective communication to achieve project goals.	The student rarely communicates effectively with teammates.	The student occasionally communicates effectively with teammates.	The student regularly communicates effectively with teammates.	The student constantly communicates effectively with teammates.

Skills for this group of SOs are developed and practiced in the following courses: CIIC 4010 – *Advanced Programming*, CIIC 4030 – *Programming Languages*, CIIC 4060 – *Database Systems*, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 13 shows details about the courses where the assessment of SO E5 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 13: Assessment strategy for SO E5

Performance Indicators	Where is Direct Assessment Done	Assessment Instruments	Target for Performance
PI-1: The student fulfills all assigned responsibilities to assure team success.	INSO 4151	Teamwork assessment tool for project contribution of the student.	80%
	CIIC 4060	Course project	75%
PI-2: The student contributes to the decision-making process to effectively meet project goals.	INSO 4151	Teamwork assessment tool for project contribution of the student.	80%
	CIIC 4060	Course project	75%
PI-3: The student maintains continuous and effective communication to achieve project goals.	INSO 4151	Teamwork assessment tool for project contribution of the student.	80%
	CIIC 4060	Course project	75%

Note: Group 6 does not apply to the SWE program

Group 7: Student Outcome E6

E6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;

Table 16 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcome in Group 7: E6.

Table 16: Rubrics for SO E6[3]

Performance Indicators	Unsatisfactory	Developing	Satisfactory	Exemplary
PI-1: The student designs and conducts experiments or processes to collect data that is relevant to solve a problem.	The student fails to design or conduct experiments.	Given a design, the student can partially conduct the experiment and collect data.	Given a design, the student can correctly conduct the experiment and collect data.	The student provides experimental design and successfully conducts all its experiments and collects data.
PI-2: The student can properly process, analyze, and interpret experimental data.	The student cannot properly process any experimental data.	The student can process experimental data but fails to properly analyze it.	The student can process and analyze experimental data but fails to properly interpret it.	The student can successfully process, analyze, and interpret the experimental data providing key insights.
PI-3: The student uses engineering judgment to derive conclusions from experimental data.	The student fails to derive any reasonable conclusion from the data.	The student draws some partial conclusions but with no engineering foundations.	The student derives some conclusions but with insufficient engineering foundations.	The student derives correct conclusions supported by appropriate engineering foundations.

Skills for Group 7 of SOs are developed and practiced in the following courses: CIIC 4050 – *Operating Systems*, CIIC 4070 – *Computer Networks*, CIIC 4082 – *Computer Architecture II*, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 17 shows details about the courses where the assessment of SO E6 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 17: Assessment strategy for SO E6

Performance Indicators for E6	Where is Direct Assessment Done	Assessment Instruments	Target for Performance
PI-1: The student designs and conducts experiments or processes to collect data that	INSO 4151	Project's progress report and final report	80%

[3]These rubrics for SOG 7 include the changes approved at the departmental meeting on April 13, 2023.

is relevant to solve a problem.	CIIC 4070	Special homework	75%
	INSO 4117	Course project	75%
PI-2: The student can properly process, analyze, and interpret experimental data.	INSO 4151	Project's progress report and final report	80%
	CIIC 4070	Special homework	75%
	INSO 4117	Course project	75%
PI-3: The student uses engineering judgment to derive conclusions from experimental data.	INSO 4151	Projects' progress report and final report	80%
	CIIC 4070	Special homework	75%
	INSO 4117	Course project	75%

Group 8: Student Outcome E7

E7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Table 18 displays the set of rubrics to be used in the assessment of the performance indicators that have been established for the student outcome in Group 8: E7.

Table 18: Rubrics for SO E7

Performance Indicators	Unsatisfactory	Developing	Satisfactory	Exemplary
PI-1: The student recognizes the need to acquire additional knowledge to solve a problem.	The student fails to recognize the need for additional knowledge.	Sometimes, the student recognizes the need for additional knowledge.	Most times, the student recognizes the need for additional knowledge.	The student always recognizes the need for additional knowledge.
PI-2: The student acquires additional knowledge when required to solve a problem, using appropriate learning strategies.	The student fails to acquire additional knowledge when required to solve a problem.	Sometimes, the student acquires additional knowledge when required to solve a problem.	Most times, the student acquires additional knowledge when required to solve a problem.	The student always acquires additional knowledge when required to solve a problem.
PI-3: The student applies additional acquired knowledge when required to solve a problem.	The student fails to apply additional acquired knowledge when required to solve a problem.	Sometimes, the student applies additional acquired knowledge when required to solve a problem.	Most times, the student applies additional acquired knowledge when required to solve a problem.	The student always applies additional acquired knowledge when required to solve a problem.

Skills for Group 8 of SOs are developed and practiced in the following courses: CIIC 4020 – *Data structures*, CIIC 4050 – Operating Systems, CIIC 4060 – *Database Systems*, CIIC 4070 – *Computer Networks*, INSO 4101 - *Introduction to Software Engineering,* INSO 4115 - *Software Engineering Requirements,* INSO 4116 - *Software Design,* and INSO 4117 - *Software Reliability and Testing.*

Table 19 shows details about the courses where the assessment of SO E7 will be done, the type of expected activity used for sampling, and the target performance goal for each PI as a percentage of the students demonstrating a score that is **satisfactory** or better in the rubric.

Table 19: Assessment strategy for SO E7

Performance Indicators for E7	Where is Direct Assessment Done	Assessment Instruments	Target for Performance
PI-1: The student recognizes the need to acquire additional knowledge to solve a problem.	INSO 4151	Projects‘ progress report and final report	80%
	CIIC 4060	Project’s final report	75%
PI-2: The student acquires additional knowledge when required to solve a problem, using appropriate learning strategies.	INSO 4151	Projects‘ progress report and final report	80%
	CIIC 4060	Project’s final report	75%
PI-3: The student applies additional acquired knowledge when required to solve a problem.	INSO 4151	Projects‘ progress report and final report	80%
	CIIC 4060	Project’s final report	75%

Assessment Cycle

We have established a 3-year cycle to complete direct assessment of all SOs. Each year in the cycle, we focus on the assessment of a specific subset of the SOs. The process has been set to begin in the year 2020. So, the first cycle would be completed in the years 2020 through 2022; the second cycle is scheduled for the period from 2023 to 2025; and so on. Again, each year in a cycle is dedicated to conducting a direct assessment of a specific subset of SOs. This process is illustrated in Table 20. The column labeled year in a cycle refers to the positional year within a cycle: first year, second year, and third year. Each positional year has a row. For each year, we show the specific set of SOs that will be under assessment.

Table 20: SOs Assessment Cycle

Year in a Cycle	Student Outcome Under Assessment That Year						
	E1	E2	E3	E4	E5	E6	E7
Year 1 (2020, 2023, 2026, …)	X	X			X		
Year 2 (2021, 2024, 2027, …)			X				X
Year 3 (2022, 2025, 2028, …)				X		X	

Table 21 further illustrates this assessment cycle by including course portfolios. For each SO, the table presents which courses are to be used to do direct assessment of the SO, as well as the year in the cycle when data collection will be done.

Table 21: SOs Assessment Cycle for SWE Program and Courses to be Sampled

Student Outcome in Assessment	CSE Courses for SO's Assessment Per Natural Year					
	Year 1 2020, 2023, 2026, …		Year 2 2021, 2024, 2027, …		Year 3 2022, 2025, 2028, …	
	Spring	Fall	Spring	Fall	Spring	Fall
Group 1: E1 Complex Problem Solving	CIIC 4070 INSO 4151	INSO 4151	-	-	-	-
Group 2: E2 Design/Implementation	INSO 4151	INSO 4101 INSO 4116 INSO 4151	-	-	-	-
Group 3: E3 Effective Communication	-	-	CIIC 4060 CIIC 4151	CIIC 4151	-	-
Group 4: E4 Professional & Ethical Issues	-	-	-	-	INSO 4115 INSO 4151	CIIC 4050 INSO 4151
Group 5: E5 Teamwork	CIIC 4060 INSO 4151	INSO 4151	-	-	-	-
Group 7: E6 Experimentation	-	-	-	-	CIIC 4070 INSO 4117 INSO 4151	INSO 4151
Group 8: E7 Self-learning	-	-	CIIC 4060 INSO 4151	INSO 4151	-	-

For a given year, the plan establishes that each SO under assessment will be sampled each semester, and on different courses. The capstone course will be sampled every semester that is offered but concentrating only on the SOs for the year of the offering.

Evaluations and Actions

For each SO under assessment, we shall follow these steps:

Step 1. **At the beginning of the semester under assessment** – the SWE Assessment Coordinator reminds the faculty about the assessment activities for the semester and, if needed, meets with the professors in charge of the courses that will be sampled. Specific information about the targeted SOs of the moment, as well as access to relevant tools to collect the final data for each course under assessment is shared with the professors in charge.

Step 2. **At the end of the semester under assessment** – the professors of the courses that were to be sampled submit the assessment data corresponding to each student that passes the course, as well as the evidence of the student's works. The CAIC evaluates the results of this process.

Step 3. **At the beginning of the next semester after assessment** – the CAIC reports to the faculty the results of the assessment data collected. If determined to be so, whenever needed, the procedures shall be recalibrated, and correcting actions shall be proposed to correct any shortcomings that are found in the targeted SOs.

Step 4. One year after the initial assessment – the CSE faculty discusses the findings for the given SO at the one-day faculty retreat. Action plans, corrections, and other proposals to improve on the SOs are presented and approved with a schedule for implementation and monitoring. The goal is to incorporate these actions for the next cycle when the SO is again under assessment.

With this procedure we close the assessment loop, translating assessment into actions based on the thorough evaluation of the results.

As we enrich our process with additional assessment instruments (e.g., exit interviews), the evaluations and action components will be updated to accommodate input on SO attainment that is obtained from those modalities.