

Investigation Example – CEAB Questionnaire – Exhibit 1

Graduate attribute # 3 Investigation

Canadian Engineering Accreditation Board definition:

An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

Indicators: Under this heading explain the rationale behind the selection of the indicators for the attribute and the justification that the indicators are unique to the attribute or a component of the attribute. Explain further how the data collected demonstrates the full scope of the attribute contained in the CEAB definition.

All the graduate attribute indicators for all programs in the School were developed through a series of nine working groups consisting of faculty members across all the engineering disciplines. The task of the working groups was to capture the details into categories (called elements and sub-elements) and then to develop Bloom's-based outcome statements related to target and threshold student performance for each attribute. Target level for outcome statement development was defined as "B" level student performance, and threshold was defined as the minimum acceptable level of performance for an SOE engineering graduate. Once the series of elements and sub-elements were defined, similar statements were then consolidated into a series of Graduate Attribute Indicators. The working group structure used to define the SOE graduate attributes allowed all faculty to be involved in the process. This was essential to the faculty becoming familiar with the definitions of the attributes and the categories and outcome statements developed.

The final framework of Graduate Attribute-Indicator-Element-Sub-element was then reviewed by the curriculum committee and passed. When completed, over 100 elements/sub-elements and approximately 300 target/threshold statements were created, which provides faculty with a depth of understanding of the outcomes expected of an SOE graduate.

There are four indicators used for the assessment of Investigation, and follow the process of initiating, designing, completing and evaluating experiments. The indicators are:

GA 3.1: Propose and test a working hypothesis

GA 3.2: Design and apply an investigation plan

GA 3.3: Analyze and interpret experimental data

GA 3.4: Assess the validity of conclusions within limitations of data and methodologies.

The extended scope of the indicator definition through to example Target and Threshold Bloom's statements is captured in the attached document "**GA-03 - Indicator Detail.xlsx**"

The full scope of the assessment across courses and levels in the program is captured in the "Assessment Tools" section below.

Assessment tools: Under this heading discuss the specific tools/instruments (exam, rubric, report etc.) for each course/learning activity where data is collected that was applied to provide evidence that an attribute (or a component of an attribute) has been demonstrated.

The investigation attribute is assessed through a number of different tools across multiple years of the program. These tools include mandatory student exit surveys in the final year capstone course and many experimental and hands-on laboratories that have students conduct experiments, measure experimental data and present findings and analysis in a report. These reports are generally evaluated using analytic rubrics that are related to the investigation indicators as appropriate. In

some cases grades from labs are used to assess the overall investigation competency when indicator-mapped rubrics are not utilized.

The student performance from the results of analytic rubrics, lab scores and student exit surveys are binned and reported in a graphical format for each assessment tool. Student work is made available to faculty to support discussions related to the student performance

The specific data used for the analysis is summarized in the file **“GA-03 - Panel Data Summary”**.

Example rubrics utilized in the assessments are provided in the following files:

- **ENG 201 GA 03 - MaterialsProjectRubric.xlsx**
- **ENG 490 GA03 - Final Project Rubric.xlsx**

Rubrics from the other assessments can be provided electronically on request.

Example results from the rubrics and student survey are presented below. Detailed charts for all assessments can be provided electronically on request.

Example Lab Data Rubric Result:

Graduate Attribute	Indicator	Results															
3. Investigation	3.1: Propose and test working hypotheses	<p style="text-align: center;">ENG XXX Example Course - Example Lab Project Indicator3.1: Propose and test working hypotheses Conclusions</p> <table border="1"> <caption>Data for Indicator 3.1: Conclusions</caption> <thead> <tr> <th>Category</th> <th>Fall 14 - n=50 Projects (%)</th> <th>Winter 15 - n=47 Projects (%)</th> </tr> </thead> <tbody> <tr> <td>Below Threshold</td> <td>~5</td> <td>~8</td> </tr> <tr> <td>Threshold</td> <td>~18</td> <td>~18</td> </tr> <tr> <td>Target</td> <td>~68</td> <td>~60</td> </tr> <tr> <td>Exceeds Target</td> <td>~15</td> <td>~15</td> </tr> </tbody> </table>	Category	Fall 14 - n=50 Projects (%)	Winter 15 - n=47 Projects (%)	Below Threshold	~5	~8	Threshold	~18	~18	Target	~68	~60	Exceeds Target	~15	~15
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Below Threshold	~5	~8															
Threshold	~18	~18															
Target	~68	~60															
Exceeds Target	~15	~15															
3. Investigation	3.2: Design and apply an investigation plan	<p style="text-align: center;">ENG XXX Example Course - Example Lab Project Indicator3.2: Design and apply an investigation plan Results</p> <table border="1"> <caption>Data for Indicator 3.2: Results</caption> <thead> <tr> <th>Category</th> <th>Fall 14 - n=50 Projects (%)</th> <th>Winter 15 - n=47 Projects (%)</th> </tr> </thead> <tbody> <tr> <td>Below Threshold</td> <td>~2</td> <td>~5</td> </tr> <tr> <td>Threshold</td> <td>~18</td> <td>~10</td> </tr> <tr> <td>Target</td> <td>~45</td> <td>~65</td> </tr> <tr> <td>Exceeds Target</td> <td>~35</td> <td>~25</td> </tr> </tbody> </table>	Category	Fall 14 - n=50 Projects (%)	Winter 15 - n=47 Projects (%)	Below Threshold	~2	~5	Threshold	~18	~10	Target	~45	~65	Exceeds Target	~35	~25
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Exceeds Target	~35	~30															

Example Exit Survey Result:

Graduate Attribute 3 - Investigation														
Result	Description													
Below Threshold	Score of 1 or 2 on Exit Survey - (1 = Strongly Disagree).													
Threshold	Score of 3 on Exit Survey													
Target	Score of 4 on Exit Survey													
Exceeds Target	Score of 5 on Exit Survey (5 = Agree Strongly).													
Graduate Attribute	Indicator	Results												
Investigation	3.1: Propose and test working hypotheses	<p>Example Exit Survey Q5. I can generate a working hypothesis and a strategy to test it.</p> <table border="1"> <caption>Data for Q5: I can generate a working hypothesis and a strategy to test it.</caption> <thead> <tr> <th>Category</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Exceeds Target</td> <td>65</td> </tr> <tr> <td>Target</td> <td>55</td> </tr> <tr> <td>Threshold</td> <td>35</td> </tr> <tr> <td>Below Threshold</td> <td>5</td> </tr> <tr> <td>Total</td> <td>165</td> </tr> </tbody> </table>	Category	Count	Exceeds Target	65	Target	55	Threshold	35	Below Threshold	5	Total	165
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Investigation	3.3: Analyze and interpret experimental data	<p>Example Exit Survey Q6. I can analyse and interpret data.</p> <table border="1"> <caption>Data for Q6: I can analyse and interpret data.</caption> <thead> <tr> <th>Category</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Exceeds Target</td> <td>85</td> </tr> <tr> <td>Target</td> <td>65</td> </tr> <tr> <td>Threshold</td> <td>15</td> </tr> <tr> <td>Below Threshold</td> <td>5</td> </tr> <tr> <td>Total</td> <td>165</td> </tr> </tbody> </table>	Category	Count	Exceeds Target	85	Target	65	Threshold	15	Below Threshold	5	Total	165
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Investigation	3.4: Assess validity of conclusions within limitations of data and methodologies	<p>Example Exit Survey Q7. I can synthesise information to reach conclusions that are supported by data.</p> <table border="1"> <caption>Data for Q7: I can synthesise information to reach conclusions that are supported by data.</caption> <thead> <tr> <th>Category</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Exceeds Target</td> <td>60</td> </tr> <tr> <td>Target</td> <td>75</td> </tr> <tr> <td>Threshold</td> <td>20</td> </tr> <tr> <td>Below Threshold</td> <td>5</td> </tr> <tr> <td>Total</td> <td>165</td> </tr> </tbody> </table>	Category	Count	Exceeds Target	60	Target	75	Threshold	20	Below Threshold	5	Total	165
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