UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Report No. 3331 Revised

MEMORANDUM

To: Executive Committee of Faculty Council

From: Dr. Graeme Norval
Chair, Undergraduate Curriculum Committee

Date: April 11, 2012 for April 26, 2012 Faculty Council Meeting

Re: **Faculty Level Graduate Attributes**

REPORT CLASSIFICATION

This is a ***Major Policy Matter: Regular Motion*** that will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for vote as a regular motion (requiring a simple majority of members voting to carry).

BACKGROUND

The list of global objectives is our interpretation of the CEAB graduate attributes as they pertain to our Faculty and the learning goals we have for our students. The global outcomes represent the major competencies we want our students to achieve in these 12 attribute areas by the time they are ready to graduate. This list is not exhaustive. There are other outcomes that individual programs will want their students to attain, and they can add to this list. The global outcomes stated here provide a basic set of requirements that will guide our curriculum development as we collect data on student performance in these dimensions and use this data to inform our curriculum decisions.

STRUCTURE

The Procedure that has been developed is attached.

PROCESS

The Undergraduate Curriculum Committee is composed of representatives from each program; the Vice-Dean, Undergraduate Studies; the Chair, First Year; the Associate Dean, Cross-Disciplinary Programs; and the Registrar's Office. The Committee meets regularly, and reviews changes to the curriculum.

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PROGRAM

All programs are involved in these changes, and the impact on students in the various programs has been considered.

PROPOSAL/MOTION

"THAT the proposed graduate attributes be approved."

Report on the Outcomes and Indicators
For the CEAB Graduate Attributes Process
Faculty of Applied Science and Engineering
University of Toronto

1. Background

In 2010 the Canadian Engineering Accreditation Board (CEAB) introduced the graduate attribute criteria to their 'Questionnaire for Evaluation of an Engineering Program'. The graduate attribute criteria are articulated in criteria 3.1 and 3.2 of the CEAB Accreditation Criteria and Procedures (2011 edition). There are 12 graduate attributes which are defined in the CEAB Accreditation Criteria and Procedures. Engineering programs in Canada which are coming up for accreditation renewal this year will need to demonstrate that they are progressing toward the implementation of an evidence based process of continual curriculum improvement in these 12 attribute dimensions. We need to demonstrate that this process will be in place by 2014, and that there is a plan for a sustainable, continuous process that will be maintained into the future.

In 2010 the Faculty created a Graduate Attributes Committee (GAC). The GAC includes representation from the 9 programs and from the other units that support student learning directly; e.g. the Engineering Communication Program (ECP). The GAC was tasked with managing the development of the continuous curriculum improvement process for the Faculty. This included deciding what parts of the process would be Faculty wide, i.e. consistent across all 9 programs, and what parts of the process would be handled at the departmental level. The GAC has met frequently for the last two year and made substantial progress.

The members of the GAC have been responsible for developing many of the materials such as the indicators and rubrics that will be presented later in this report. However, the GAC has also frequently invited other faculty to participate in the process. For example, the outcomes on teamwork were initially developed in collaboration with the Leaders of Tomorrow program. In total, more than 20 faculty have participated actively in the graduate attribute process to date.

This participation rate has added substantially to the resources we have available to successfully implement this system. The GAC members and other faculty and staff who worked with the GAC have developed a level of understanding that will allow them to successfully translate the Faculty materials we have developed into effective, valid instruments for assessing learning outcomes and to interpret the resulting data. The programs will be reporting on their outcomes, interpretation of data, and analysis to the GAC during the implementation phase of the project. This exchange of information and vetting of the results will serve to keep all programs moving forward on implementation and support a high level of quality in the process.

2. Methodology

The methodology used at the University of Toronto follows the process suggested by the Engineering Graduate Attributes Development (EGAD) group, an advisory group to the National Council of the Deans of Engineering and Applied Science. The 5 step process involves:

1. Program evaluation
2. Curriculum mapping
3. Collecting data on student learning
4. Analyzing and interpreting the data
5. Data informed curriculum improvement

Step 1: The Graduate Attributes Committee (GAC) has spent most of their effort over the last two years in the first step, program evaluation. This work involved developing a set of global learning outcomes that are common across the Faculty and address all 12 of the graduate attributes. The global outcomes define the competencies that we believe all University of Toronto engineering students should achieve by graduation in the 12 dimensions of the attributes. However, the global outcomes represent fairly high level goals that are not directly measurable. To assess the global outcomes the GAC has developed a set of measurable indicators. This process and the results are discussed in more detail in section 3.

Step 2: Concurrent with the GAC work, each program was tasked with developing a set of curriculum maps. These curriculum maps illustrate where material associated with the attributes (and global outcomes) is taught; where students have an opportunity to practice skills associated with the attributes; and where students demonstrate their competency and are assessed in these dimensions. The curriculum maps are unique for each program. They show the direct formal assessment that we propose to use to collect data on student learning outcomes. They also show the proposed indirect measures that will be used to round out the data set.

Step 3: The data collection is targeted at assessment points in the program where we can measure the defined global outcomes. We have taken a two-pronged approach to the data collection process. At the Faculty level the GAC is developing rubrics for the indicators. The rubrics developed by the GAC are meant to be used as a starting point, or exemplar set, for instructors who will be collecting data for the graduate attribute process. Simultaneously, at the program level data is being collected in a select set of courses. This pilot data collection project is allowing instructors to get an understanding of the adjustments they will need to make to their assessment methods in order to align the assessment with the outcomes they want to measure. Through this process we have learned that many of the rubrics and other assessment tools we have been using require some modification to improve the validity of the data collection methodology.

Step 4: We have just begun to analyze the data we have collected. To date the data collected is very sparse and primarily concentrated on the major design components in the curricula. At this stage in the implementation of the graduate attribute process, the data collection is teaching us more about our collection methodology than producing meaningful results.   However, in the next two years this data collection process will become a routine, annual procedure. The goal is to gather enough data to allow us to make well informed changes to our curriculum, without gathering so much data that collection process is onerous.

Step 5: We have not progressed to the point where we can substantially begin data informed curriculum improvement. However, we have developed a plan for continuous curriculum improvement. Our plan will be implemented in 2012/13 and will result in data that can be used for curriculum reform. Following the analysis of the data, the first significant round of data informed curriculum improvement will occur in 2013/14.

3. Outcomes and Indicators

The Graduate Attributes Committee (GAC) took a three step approach to the development of the indicators that will be used as the foundation for the continuous curriculum improvement process. In this explanation of the development of our indicators we make reference to "assessment points". These are points in the students' development where we are assessing their proficiency in relation to a particular indicator. The assessment is a measure of the quality of a performance (e.g. oral presentation) or artifact (e.g. written response to an exam question) that demonstrates learning. The assessment point could be direct, such as an exam or lab report, or indirect, such as a survey or annual data on academic offense cases.

As a first step, the GAC developed global outcomes based on each attribute. The global outcomes[1] represent our learning priorities for our students, and define broadly the competencies we want our students to achieve by graduation. The global outcomes developed by the GAC are common across all 9 of the programs in the Faculty of Applied Science and Engineering at the University of Toronto. The global outcomes associated with each attribute are shown in Appendix B. We have developed between 2 and 4 essential global outcomes for each attribute. This should be enough for us to identify areas of strength and weakness across the attributes and within each attribute (to inform our curriculum evolution) while not trying to assess so many aspects of each attribute that we create an unsustainably onerous data collection system. The global outcomes are important because they create a shared understanding of the competencies we want our students to achieve. And any program is free to add additional outcomes to this basic list if they wish. However, global outcomes are not specific enough to be measured directly. They serve as an intermediate step to creation of measurable indicators.

In the second step, the GAC developed indicators based on the global outcomes that we had defined. There are many educational outcomes, i.e. indicators, that could be associated with each of the global

[1] The term "global outcomes" as it is used here is synonymous with "global objectives" as defined by Anderson, Krathwohl et al. in A Taxonomy for Learning, Teaching, and Assessing, 2001. They state "Global objectives are complex, multifaceted learning outcomes that require substantial time and instruction to accomplish. They are broadly stated and encompass a large number of more specific objectives." (p. 15)

outcomes. To create a meaningful and sustainable data collection methodology we used the concept of leading indicators[2], which serve to identify key performance indicators of learning for each of the global outcomes. The GAC developed these indicators at the Faculty level without reference to a specific program or point of assessment within a given program. The indicators at this level are, therefore, necessarily somewhat general. The GAC also defined more indicators than any one program could, or should, use. The list is not extensive; each indicator is central to the global outcome it purports to measure. However, giving a range of indicators allows each of the 9 programs to select a subset that best fits with their current courses, extra or co-curricular activities, and assessment methods.

In the third step, each program needs to select a subset of indicators to use to assess the global outcomes. They are generally choosing from the Faculty list of indicators, and adapting these to fit the specific type of performance they are assessing. For example, a program might pick “Describe the causes of a problem and its effects”, from the Faculty list of indicators for Problem Analysis. Suppose they want to apply this indicator to assess student performance on an assignment such as a report on traffic congestion in Toronto written in a third year Civil Engineering course. The program may choose to modify the indicator to read “Describes the causes of traffic congestion in Toronto and its effects” to include as a criteria on their marking rubric. The results from this assessment will indicate to some degree the cohort’s “demonstrated ability to identify and characterize an engineering problem” which is the global outcome associated with this indicator. This data, combined with results from other assessment information in this global outcome category will produce a picture of the achievement level of the cohort on this outcome.

A different program may choose “Classify a given problem, and the type of solution sought” from the same global outcome indicator list. They may, for example, modify this to fit a question asked on a final exam; e.g. “Part a) Given the stated problem, classify this problem as under determined, over determined or indeterminate and identify the type of solution sought.” The performance results from this part of this question would be collected to indicate the class’ “demonstrated ability to identify and characterize an engineering problem.” Although this is a different indicator than the example from the Civil course, the data indicates the level of proficiency of the students on the same global outcome. Basically, this is two different ways to measure performance quality on the same outcome.

To create a reliable data set each program needs to select a broad set of indicators. The set they choose should cover every outcome. And they need to apply these indicators at a number of assessment points (pre-existing or new) in their program to generate a reliable data set. In CEAB terminology this is referred to as triangulation. If none of the indicators developed by the Faculty GAC suits the assessment point they have chosen, then a program is free to develop another indicator that aligns well with the global outcome. However, this new indicator will be brought up for review by the GAC to confirm that it

[2] The term “leading indicator” is a term most often associated with economic assessment. Gloria Rogers, an expert in educational assessment, has suggested the concept of leading indicators is a useful way of understanding the role of performance indicators in outcomes based accreditation processes. See G. Rogers blog entry posted May 29, 2010: http://programassessment.blogspot.com/2010/05/what-is-performance-indicator-anyway.html

is a leading indicator that is well aligned. Not every outcome can be assessed at every assessment point, for example it is not reasonable to try to assess every outcome based on a final design report in a capstone design course. Therefore it is important to consider both whether the indicator is well aligned with the outcome, and also whether the indicator is well aligned with the assessment (performance or artifact). This review process by the GAC not only ensures the integrity of the indicator list in the Faculty, but also makes the new indicator available to other programs who may find that it fits an assessment point they would like to use for gathering data.

4. Conclusion

The list of global objectives is our interpretation of the CEAB graduate attributes as they pertain to our Faculty and the learning goals we have for our students.   The global outcomes represent the major competencies we want our students to achieve in these 12 attribute areas by the time they are ready to graduate. This list is not exhaustive. There are other outcomes that individual programs will want their students to attain, and they can add to this list. The global outcomes stated here provide a basic set of requirements that will guide our curriculum development as we collect data on student performance in these dimensions and use this data to inform our curriculum decisions.

Appendix A

University of Toronto: Attribute Tables

3.1.1 **A knowledge base for engineering:** Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

Global Outcomes	**Indicators**
Demonstrate competence in mathematics and modeling.	Recognize functional relationships between independent and dependent variables. Describe the physical meaning of functions, derivatives of functions, and integrals of functions (e.g., slopes or areas or volumes or surfaces). Demonstrate ability to construct a mathematical model to describe a physical system. Demonstrate ability to obtain valid solutions to a model, including the application of integral and differential calculus and linear algebra.
Demonstrate competence in natural sciences and engineering fundamentals.	Fundamental scientific and physical principles essential to engineering. Ideally these should include: Conservation laws, Newtonian mechanics, fundamentals of electricity and magnetism, thermodynamics, atomic structure of matter, chemical interactions. Identify fundamental scientific and engineering principles that govern the performance of a given process or system. • Accurately apply fundamental natural science and engineering science knowledge and principles.
Demonstrate competence in specialized engineering knowledge appropriate to the program.	List of areas of scientific and engineering knowledge relevant to the student's discipline: (For ECE: Photonics and semiconductor physics, Electromagnetics and energy systems, Analog and digital electronics, Control, communications and signal processing, Computer hardware and computer networks, Software.) Identify scientific and engineering principles that govern the performance of a given process or system. • Accurately apply the natural and engineering principles relevant to the student's discipline.

3.1.2 **Problem analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

Global Outcomes	**Indicators**
Demonstrate the ability to identify and characterize an engineering problem	• Recall the types of problems that engineers encounter: simple, complex; determinate, indeterminate; open-ended, closed-ended; degree of accuracy required in the solution. • Describe the causes of the problem and its effects. • Classify a given problem, and the type of solution sought. • Recognize the mathematical, engineering and other relevant knowledge that applies to a given problem.
Demonstrate the ability to formulate a solution plan (methodology) for an engineering problem.	• Determine primary objectives and key constraints (consider the primary stakeholders). • Reframe complex problems into interconnected sub-problems. • Identify existing solution processes that can be applied to solve a problem. • Recognize missing information: information that needs to be gathered, or assumptions that need to be made. • Compare and contrast alternative solution processes to select the best process. • Plan a systematic solution process. • Determine evaluation criteria for assessing alternative solution plans to open ended problems.
Demonstrate the ability to formulate and interpret a model.	• Choose a model (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy. • Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required. • Formulate the model in engineering terms. • Interpret modeling results of processes or systems using scientific and engineering principles.
Demonstrate the ability to execute solution process for an engineering problem.	• Implement solutions to simple problems. • Evaluate alternative solutions to open-ended problems and select final solution. • Identify sources of error in the solution process, and limitations of the solution. • Validate the solution to a complex engineering problem.

3.1.3 **Investigation:** 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.

Global Outcomes	**Indicators**
Demonstrate the ability to define a problem	Lower level • Describe how to define a problem for purposes of investigation • Explain how to find previous work Graduating level • State the problem, its scope and importance • Describe the previous work • State the objective of the work
Demonstrate the ability to devise and execute a plan to solve a problem	Lower level • Describe standard tests (experiments) and methods for information collection Graduating level • Select a set of tests to be conducted • Select, plan and apply the methods for collecting the information • Identify limitations of the tests and methods used and their impact on the results.
Demonstrate the ability to use critical analysis to reach valid conclusions supported by the results of the plan	• Analyze the results • Formulate the conclusions • Validate conclusions by induction or deduction • Compare conclusions with previous work • Characterize the limitations and implications of the conclusions

3.1.4 **Design:** An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

Global Outcomes	**Indicators**
Demonstrate ability to frame a complex, open-ended problem in engineering terms.	• Elicit and document engineering requirements from stakeholders • Synthesize engineering requirements from a review of the State of the Art • Extract engineering requirements from relevant engineering Codes and Standards • Explore and synthesize engineering requirements from larger social and professional concerns
Demonstrate ability to generate a diverse set of candidate engineering design solutions.	• Apply formal idea generation tools to develop a diverse set of candidate engineering design solutions • Adapt reference designs to generate a diverse set of candidate engineering design solutions • Use models, prototypes, etc., to generate a diverse set of candidate engineering design solutions
Demonstrate ability to select candidate engineering design solutions for further development.	• Apply formal multi-criteria decision making tools to select candidate engineering design solutions for further development • Use the results of experiments and analysis to select candidate engineering design solutions for further development • Consult with domain experts and stakeholders to select candidate engineering design solutions for further development
Demonstrate ability to advance an engineering design to a defined end state.	• Refine a conceptual design into a detailed design • Implement, or provide a plan to implement, a conceptual or detailed design • Redevelop or iterate a conceptual design

3.1.5 **Use of engineering tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

Global Outcomes	**Indicators**
Demonstrate ability to use fundamental modern techniques, resources and engineering tools.	• Demonstrate ability to apply fundamental engineering tools, techniques and resources in engineering activities for the purpose of: o Acquiring information: Use of library and internet references o Modeling and simulating systems: Use of simulation software, prototype/simplified physical models o Monitoring system performance: Measuring instruments, monitoring software o Creating engineering designs: Use of CAD tools
Demonstrate ability to use discipline specific techniques, resources and engineering tools.	Departments fill in here: short list of tools that are important and specific to the discipline • Demonstrate ability to use engineering tools, techniques and resources specific to the student's discipline.
Demonstrate recognition of limitations of the tools used.	• Recognize the assumptions and simplifications used in a model or a simulation and their impact on the results. • Recognize the limitations of the capabilities of the tools used. • Recognize accuracy and sources of error in measurements, modeling or simulations.

3.1.6 **Individual and team work:** An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

Global Outcomes	**Indicators**
Demonstrate ability to establish and monitor team organizational structure*	• Establish and use norms of practice (e.g. rules, roles, charters, agendas, etc.) • Re-assess and refine team's norms of practice during the course of a project • Assess individual contributions to a team activity and provide feedback
Demonstrate ability to promote team effectiveness through individual action*	• Apply formal models of team and individuals (e.g. psychometrics, team role models, etc) to adapt individual actions to team norms • Demonstrate effective communication within the team • Demonstrate trust and accountability within the team
Demonstrate success in a team based project	• Complete a successful project* • Present results as a team, with smooth integration of contributions from all individual efforts

* Measurement methods could include peer assessment, attribution tables, reflection and observation by an instructor amongst others.

3.1.7 **Communication skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

Global Outcomes	**Indicators**
Demonstrate the ability to identify and credibly communicate engineering knowledge.	• Recognize and explain context of a particular engineering design or solution in relation to past and current work as well as future implications. • Recognize credible evidence in support of claims, whether the evidence is presented in written, oral or visual form (reading). • Formulate, in written, visual and/or spoken form, credible and persuasive support for a claim. • Organize written or spoken material– to structure overall elements so that their relationship to a main point and to one another is clear. • Create “flow” in a document or presentation – flow is a logical progression of ideas, sentence to sentence and paragraph to paragraph.
Demonstrate the ability to use different modes of communication.	• Relate ideas in a multi-modal manner – visually, textually and/or orally. • Incorporate various media effectively in a presentation or written documents.. • Tailor the mode of presentation, depending on the situation, whether it is a formal talk, a technical report or a poster presentation, etc., and to accommodate different learning styles..
Demonstrate the ability to develop communication through an iterative process.	• Use iteration to clarify and amplify understanding of issues being communicated. • Use reflection to determine and guide self-development.

3.1.8 **Professionalism:** An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.

Global Outcomes	**Indicators**
Demonstrate the ability to describe engineering roles in a broader context, e.g. as pertains to the environment, health, safety, and public welfare	• Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest • Explain the basic concepts of risk management (hazard vs risk; identification, assessment, mitigation, tolerance, etc) • Consider the entire life cycle within such an explanation including risk to the public, and the environment
Demonstrate the ability to recognize the impacts of engineering within a global society (the broader public interest)	• Recognize the limitations of regulations, codes and standards, and the limits of a life cycle analysis, when performing engineering design and analysis in a global context • Identify options, select and defend a preferred option as part of an integrated design experience • Recognize stakeholders and their interests and objectives
Demonstrate the ability to behave in a professional manner	• Demonstrate RAGAGEP (Recognized as Generally Accepted Good Engineering Practice) appropriate to the discipline, including regulations, standards, guidelines, quality of written work • Demonstrates professional etiquette and conduct as illustrated in the Guideline on Professional Practice, particularly with regards to interpersonal relations • Demonstrate duty to the profession • Ability to recognize and avoid misconduct

3.1.9 **Impact of engineering on society and the environment:** An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.

Global Outcomes	**Indicators**
Demonstrate understanding of the relationships among technology and the social, cultural, economic and environmental conditions of society, locally and globally, in both the short-and long-term.	● Explain the interconnectedness of social and technological development, including both the impacts of technology on society and impacts of society on technology ● Identify the possible social, cultural, environmental and human health-related impacts over the life-cycle of an engineering product or activity relevant to the student's discipline ● Identify and evaluate the potential risks (likelihood and consequences) to human health and the environment of an engineering product or activity relevant to the student's discipline ● Identify relevant viewpoints and stakeholders in an engineering activity
Demonstrate the ability to identify and choose alternative ways to mitigate or prevent adverse social, environmental, human health and safety impacts.	● Compare technological alternatives and identify means to mitigate the social, environmental, human health and safety impacts ● Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the student's discipline
Demonstrate awareness of legal issues relevant to an engineering activity.	● Identify legal requirements relevant to a specific engineering activity, such as standards, codes or regulations ●

3.1.10 **Ethics and equity:** An ability to apply professional ethics, accountability, and equity.

Global Outcomes	**Indicators**
Demonstrate the ability to recognize ethical and equity based dilemmas	• Distinguish the differences between ethics, and legality (i.e. legal standard) • Articulate the issues involved in ethical case studies (given a case study) • Articulate the issues involved in case studies involving equity problems
Demonstrate the ability to apply the Code of Ethics and equity principles	• Analyze a case, describe and defend an appropriate response in which the Code of Ethics (PEO) is applied • Ability to work with a diverse group of people(s) in a mutually respectful manner • Apply a code of ethics and/or equity principles in the context of a course project or team project
Demonstrate the ability to act ethically and demonstrate individual accountability	• Demonstrate ability to behave in accordance with the Code of Behaviour on Academic Matters • Demonstrate ability to behave in accordance with other Codes of the University (e.g. the Code of Student Conduct)

3.1.11 **Economics and project management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

Global Outcomes	**Indicators**
Demonstrate ability to estimate the life-cycle economic and financial costs and benefits for relevant engineering activities	• Identify the various types of economic and financial benefits and costs of an engineering activity • Identify credible estimates of the costs and benefits • Recognize the uncertainties in the estimates
Demonstrate ability to evaluate the economic and financial performance of an engineering activity and compare alternative proposals on the basis of these measures	• Calculate appropriate economic and financial performance measures of an engineering activity • Choose the most appropriate alternative based on economic and financial considerations • Explain the implications of inflation, taxes and uncertainties on these values and comparisons
Demonstrate ability to read and understand financial statements for engineering activities	• Explain the various types of financial statements and the terminology used in them, and calculate key financial measures
Demonstrate ability to plan and manage engineering activities to be within time and budget constraints	• Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks • Determine and adjust the schedule of tasks and their resources to complete an engineering activity on time and within budget

3.1.12 **Life-long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

Global Outcomes	**Indicators**
Demonstrate the ability to independently summarize, analyze, synthesize and evaluate information from a wide variety of sources *(learning independently)*	• Summarize the key points in an assigned reading • Connect new, self-taught, material to more formally taught knowledge. • Organize knowledge independently, and using methods distinct from instructor provided materials; such as creating notes, outlining, concept maps, responses to reflective questions, arguments or workbooks
Demonstrate the ability to develop a strategy to identify and address gaps in knowledge *(becoming a self-directed learner)*	• Identify the deficiencies or gaps of understanding uncovered through reading or reflective review • Create a plan to address new material that has not been formally taught •