

Indicators should:

1. Be measureable and meaningful
2. Have: content, context, and verb
3. Be useful to YOU to identify key expectations of students.

Possible subject topics for graduate attribute indicators

	Attribute	Starting points for creating indicators...		Attribute	Starting points for creating indicators...
1	Knowledge	Key concepts/Threshold concepts in discipline Process of developing knowledge in the discipline	7	Individual and team work	Approaches to leadership Behavioural approaches Conflict resolution Giving and receiving feedback
2	Problem analysis	Closed and open-ended problem solving Convergent and divergent thinking Critical thinking	8	Professionalism	Legal and regulatory framework for engineering Professional obligations Safety Assessing and managing risk
3	Investigation	Design of experiment Analysis and interpretation of data Error estimation Drawing conclusions from investigation	9	Impact on society and environment	Sustainability Lifecycle analysis Social impact of engineering
4	Engineering tools	Selection of tools Application of tools Uncertainty associated with tools	10	Ethics and equity	Codes of ethics Ethical framework for decision making Working with diverse groups Equity
5	Design	Design process stages (problem definition, preliminary design, ...) Stakeholders, safety, social impact General engineering design tools Discipline specific design	11	Economics and project management	Economic tools Business plans Project management Change management
6	Communications	Written, oral, graphical communications Writing process stages Formal and informal writing	12	Lifelong learning	Self-regulation (monitoring, evaluating, and improving approaches to learning) Information literacy Opportunities for ongoing professional development

Taxonomies of Learning Outcomes

Bloom's (Anderson's) Taxonomy of Cognitive Learning Outcomes

<p>Knowledge (Remembering) – Retrieving, recalling or recognizing knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.</p> <p><u>Sample verbs</u>: define, recall, identify, name, recognize, list, repeat, duplicate, label, match, order, reproduce, state</p> <p><u>Examples</u>: state specific facts, define terminology, recall sequences and procedures, state rules and principles, recall equations, put a list in order, match term to definition, etc.</p>		
<p>Comprehension (Understanding) – The ability to grasp or construct meaning.</p> <p><u>Sample verbs</u>: paraphrase, identify, illustrate, describe, explain, differentiate, classify, give example, indicate, locate, rewrite, restate, summarize, interpret</p> <p><u>Examples</u>: state in your own words, explain a principle or concept, illustrate with an example, explain the meaning of each term in an equation, differentiate between two methods, draw a diagram to describe, etc.</p>		
<p>Application (Applying) -- Carrying out or using a procedure. Ability to implement material in concrete situations.</p> <p><u>Sample verbs</u>: apply, employ, determine, calculate, formulate, show, develop, use, demonstrate, compute, derive, predict, produce, solve, write, implement.</p> <p><u>Examples</u>: use a principle or concept to calculate, solve a problem using a known method, apply a formula to determine a result, apply principles of professional writing, implement a lab procedure.</p>		
<p>Analysis (Analyzing) – Breaking material or concepts into parts, determining how parts work and relate, and relate back to overall structure and organization.</p> <p><u>Sample verbs</u>: analyze, compare, contrast, investigate, examine, discriminate, deduce, explore.</p> <p><u>Examples</u>: analyze a system, examine a structure, explore an idea, critically dissect a design or solution.</p>	<p>Synthesis (Creating) – Ability to put parts together to form a coherent and unique whole. Arrange elements in a new way.</p> <p><u>Sample verbs</u>: design, compose, produce, invent, assemble, construct, create, document, write, relate, propose, develop, plan, generate.</p> <p><u>Examples</u>: write an report, design a product or system, plan a process, develop a unique solution.</p>	<p>Evaluation (Evaluating) – Making judgments based on criteria and standards. Ability to critique the value of an idea for a purpose.</p> <p><u>Sample verbs</u>: evaluate, judge, assess, compare, validate, argue, decide, choose, appraise, rate, conclude, select, criticize, estimate, infer, deduce, defend, justify.</p> <p><u>Examples</u>: evaluate alternative solutions or methods, critique a design, create a credible argument.</p>

Other verbs that might be useful: arrange, recognize, classify, convert, distinguish, predict, review, change, modify, operate, prepare, schedule, sketch, use, diagram, discriminate, model, test, arrange, collect, combine, comply, generate, manage, reconstruct, draw...

Verbs to avoid if possible: know, understand, learn, believe, Any verb that is vague or impossible to assess. You want outcomes that result in an product or performance that can be assessed.

Psychomotor Taxonomy (Dave):

- **Imitation** — Observing and patterning behavior after someone else.
- **Manipulation** — Being able to perform certain actions by following instructions and practicing.
- **Precision** — Refining, becoming more exact. Few errors are apparent.
- **Articulation** — Coordinating a series of actions, achieving harmony and internal consistency.
- **Naturalization** — Having high level performance become natural, without needing to think much about it.

Taken from: <http://www.nwlink.com/~donclark/hrd/bloom.html>

Affective Taxonomy

Receiving is being aware of or sensitive to the existence of certain ideas, material, or phenomena and being willing to tolerate them. Examples include: to differentiate, to accept, to listen (for), to respond to.

Responding is committed in some small measure to the ideas, materials, or phenomena involved by actively responding to them. Examples are: to comply with, to follow, to commend, to volunteer, to spend leisure time in, to acclaim.

Valuing is willing to be perceived by others as valuing certain ideas, materials, or phenomena. Examples include: to increase measured proficiency in, to relinquish, to subsidize, to support, to debate.

Organization is to relate the value to those already held and bring it into a harmonious and internally consistent philosophy. Examples are: to discuss, to theorize, to formulate, to balance, to examine.

Characterization by value or value set is to act consistently in accordance with the values he or she has internalized. Examples include: to revise, to require, to be rated high in the value, to avoid, to resist, to manage, to resolve.