Student Outcomes and Performance Indicators

A performance indicator identifies the performances that the faculty will look for in order to determine whether or not a student outcome is met. Indicators facilitate the development of the curriculum and also focus the data collection process. In addition to the outcomes, the performance indicators should be communicated to students in the program description and stated in terms that inform the students about the general purpose of the program and expectations of the faculty. The primary difference between student outcomes and performance indicators is that student outcomes are intended to provide general information about the focus of student learning and are broad statements of the expected learning, while performance indicators are concrete measurable performances students must meet as indicators of achievement of the outcome. For example, student outcomes can be stated as follows:

- Students will work effectively as a member of a team.
- Students can apply the principles of math and science to a technical problem.
- Students will have the ability to engage in lifelong learning.
- Students will have effective communication skills.

Faculty can usually agree on the general outcomes that students should demonstrate by the end of the academic program. However, without a common agreement as to what specific performances should be expected from students around each of the outcomes there is no way to have a systematic, efficient nor meaningful process of data collection to determine if the outcomes have been met. The development of performance indicators is unquestionably the most critical part of developing a systematic and meaningful data collection process around program assessment and improvement.

Performance indicators identify what concrete actions the student should be able to perform as a result of participation in the program. Once program outcomes have been identified, the knowledge and skills necessary for the mastery of these outcomes should be listed. This will allow the desired behavior of the students to be described, and will eliminate ambiguity concerning demonstration of expected competencies. Performance indicators are made up of at least two main elements; an action verb, which identifies the depth to which students should demonstrate the performance, and the content referent, which is the focus of the instruction. The expected behavior must be specific, using an observable action verb such as demonstrate, interpret, discriminate, or define. The following is an example of an outcome with its performance indicators:

Outcome: Students should be able to conduct an experiment and interpret data

Performance indicators:
Students will be able to demonstrate the ability to:

- Follow the design of an experiment plan (knowledge)
- Acquire data on appropriate variables (application)
- Compare experimental results to appropriate theoretical models (analysis)
- Offer explanation of observed differences between model and experiment (evaluation)

Further Reading:

1. Cunningham, G. K. (1986). Educational and psychological measurement. New York: MacMillan Publishing.
2. McBeath, R. J., Ed. (1992). Instructing and evaluating in higher education: A guidebook for planning learning outcomes. Englewood Cliffs, NJ: Educational Technology Publications.
3. Olds, B. M., Miller, R. L. (1998) An Assessment Matrix for Evaluating Engineering Programs. J Engineering Education 87 (2): 173-178.
4. Shuman, L. J., Besterfield-Scare, M., McGourty, J. (2005) The ABET "Professional Skills" – Can they be taught? Can they be assessed? J Engineering Education 94 (1): 41-55.

COGNITIVE learning is demonstrated by knowledge recall and the intellectual skills: comprehending information, organizing ideas, analyzing and synthesizing data, applying knowledge, choosing among alternatives in problem-solving, and evaluating ideas or actions.

Level	Illustrative Verbs	Definition	Example
Knowledge	arrange, define, describe, duplicate, identify, label, list, match, memorize, name, order, outline, recognize, relate, recall, repeat, reproduce, select, state	remembering previously learned information	memory of specific facts, terminology, rules, sequences, procedures, classifications, categories, criteria, methodology, principles, theories, and structure
Comprehension	classify, convert, defend, describe, discuss, distinguish, estimate, explain, express, extend, generalize, give examples, identify, indicate, infer, locate, paraphrase, predict, recognize, rewrite, report, restate, review, select, summarize, translate	grasping the meaning of information	stating problem in own words, translating a chemical formula, understanding a flow chart, translating words and phrases from a foreign language
Application	apply, change, choose, compute, demonstrate, discover, dramatize, employ, illustrate, interpret, manipulate, modify, operate, practice, predict, prepare, produce, relate, schedule, show, sketch, solve, use, write	applying knowledge to actual situations	taking principles learned in math and applying them to figuring the volume of a cylinder in an internal combustion engine
Analysis	analyze, appraise, break down, calculate, categorize, compare, contrast, criticize, diagram, differentiate, discriminate, distinguish, examine, experiment, identify, illustrate, infer, model, outline, point out, question, relate, select, separate, subdivide, test	breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized	discussing how fluids and liquids differ, detecting logical fallacies in a student's explanation of Newton's 1st law of motion
Synthesis	arrange, assemble, categorize, collect, combine, comply, compose, construct, create, design, develop, devise, design, explain, formulate, generate, integrate, manage, modify, organize, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize, synthesize, tell, write	rearranging component ideas into a new whole	writing a comprehensive report on a problem-solving exercise, planning a program or panel discussion, writing a comprehensive term paper
Evaluation	appraise, argue, assess, attach, choose, compare, conclude, contrast, defend, describe, discriminate, estimate, evaluate, explain, judge, justify, interpret, relate, predict, rate, select, summarize, support, value	making judgments based on internal evidence or external criteria	evaluating alternative solutions to a problem, detecting inconsistencies in the speech of a student government representative

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AFFECTIVE learning is demonstrated by behaviors indicating attitudes of awareness, interest, attention, concern, and responsibility, ability to listen and respond in interactions with others, and ability to demonstrate those attitudinal characteristics or values which are appropriate to the test situation and the field of study.

Level	Illustrative Verbs	Definition	Example
Receiving	asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, sits erect, replies, uses	willingness to receive or attend	listening to discussions of controversial issues with an open mind, respecting the rights of others
Responding	answers, assists, complies, conforms, discusses, greets, helps, labels, performs, practices, presents, reads, recites, reports, selects, tells, writes	active participation indicating positive response or acceptance of an idea or policy	completing homework assignments, participating in team problem-solving activities
Valuing	completes, describes, differentiates, explains, follows, forms, initiates, invites, joins, justifies, proposes, reads, reports, selects, shares, studies, works	expressing a belief or attitude about the value or worth of something	accepting the idea that integrated curricula is a good way to learn, participating in a campus blood drive
Organization	adheres, alters, arranges, combines, compares, completes, defends, explains, generalizes, identifies, integrates, modifies, orders, organizes, prepares, relates, synthesizes	organizing various values into an internalized system	recognizing own abilities, limitations, and values and developing realistic aspirations
Characterization by a value or value complex	acts, discriminates, displays, influences, listens, modifies, performs, practices, proposes, qualifies, questions, revises, serves, solves, uses, verifies	the value system becomes a way of life	a person's lifestyle influences reactions to many different kinds of situations

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PSYCHOMOTOR learning is demonstrated by physical skills: coordination, dexterity, manipulation, grace, strength, speed; actions which demonstrate the fine motor skills such as use of precision instruments or tools, or actions which evidence gross motor skills such as the use of the body in dance or athletic performance.

Level	Illustrative Verbs	Definition	Example
Perception	chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects, separates	using sense organs to obtain cues needed to guide motor activity	listening to the sounds made by guitar strings before tuning them, recognizing sounds that indicate malfunctioning equipment
Set	begins, displays, explains, moves, proceeds, reacts, responds, snows, starts, volunteers	being ready to perform a particular action: mental, physical or emotional	knowing how to use a computer mouse, having instrument ready to play and watching conductor at start of a musical performance, showing eagerness to assemble electronic components to complete a task
Guided response	assembles, builds, calibrates, constructs, dismantles, displays, dissects, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches	performing under guidance of a model: imitation or trial and error	using a torque wrench just after observing an expert demonstrate a its use, experimenting with various ways to measure a given volume of a volatile chemical
Mechanism	(same list as for guided response)	being able to perform a task habitually with some degree of confidence and proficiency	demonstrating the ability to correctly execute a 60 degree banked turn in an aircraft 70 percent of the time
Complex or overt response	(same list as for guided response)	performing a task with a high degree of proficiency and skill	dismantling and re-assembling various components of an automobile quickly with no errors
Adaptation	adapts, alters, changes, rearranges, reorganizes, revises, varies	using previously learned skills to perform new but related tasks	using skills developed learning how to operate an electric typewriter to operate a word processor
Origination	arranges, combines, composes, constructs, creates, designs, originates	creating new performances after having developed skills	designing a more efficient way to perform an assembly line task

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Cognitive Levels, Terms and Assessment Task
Gloria Rogers with Susan Hatfield

Learning levels	Level Indicators	Assessment Task
Knowledge	Define Describe Label Recite Select State Write Identify	**Remembering previous learned information:** -Complete multiple choice -Fill in the blank -Provide oral response -Complete true/false -Develop a list -Choose among alternatives (could be a list)
Comprehension	Match Paraphrase Restate Illustrate Compare Predict Defend Explain	**Grasping the meaning of Information previously presented:** -Give an analogy -Create an outline -Summarize in own words -Create a concept map -Draw a diagram -Graph the answer -Match term with a definition
Application	Apply Change Make Model Show Calculate Examine Solve Use	**Using principle/formula/processes previously learned:** -Compute an answer -Solve a problem similar to previous problems -Solve a problem in a new setting -Create a model -Write an essay that requires the use of the concepts/processes learned -Use theory or principle to explain an event or phenomena
Analysis	Analyze Compare/contrast Differentiate Categorize Distinguish Relate	**Breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized:** -Deconstruct a model -Identify differences -Group like items together -Identify what is missing -Identify cause and effect -Perform a SWOT analysis -Discuss an event/ perspective from multiple perspectives -Present the potential impact resulting from a decision or choice
Evaluation	Evaluate Select Recommend Rank Critique Judge Assess	**Making judgments based on internal evidence or external criteria:** -Choose best among options and defend your choice -Rank from best to worse using establish criteria -Develop criteria for judgment and apply to a solution -Recommend and defend choice for action -Present the pros and cons of an approach -Determine the degree of success or failure of an action or event
Create	Make Generate Build Form Construct Design Fashion Produce	**Making or producing something based on previously learned information and processes:** -Create an end-of program capstone project -Complete a summative class project -Write a summative paper in a course -Write an end-of program thesis -Write an end-of program dissertation -Design an original approach to a situation or problem --Conduct independent research