Learning Objectives

Learning objective (or instructional objective): A statement of something specific and observable students should be able to do after receiving instruction, plus (optional) conditions under which they would do it and/or what would constitute acceptable performance.

By the end of this [course, section of the course, week, lecture], the student will be able to *** where *** begins with an action word (explain, calculate, design,...).

Examples grouped according to their levels on Bloom's Taxonomy (p. B4):

Remembering
- list [the steps in Polya's problem-solving model]
- identify [five key provisions of the Clean Air Act]
- outline [the procedure for calibrating a gas chromatograph]

Understanding
- explain [in your own words the role of each step in Polya's model]
- describe [each of the organelles found in animal cell cytoplasm]
- interpret [the output from a SAS ANOVA calculation]
- distinguish [between cognitive and social constructivism]

Applying
- apply [Polya's model to the solution of a given problem]
- calculate [the probability that two sample means will differ by more than 5%]
- solve [the compressibility factor equation state for P, T, or V from the other two]

Analyzing
- classify [a complex problem solution in terms of the steps of Polya's model]
- predict [the conflicts likely to arise when students with specified learning styles work on a cooperative learning team]
- explain [why we feel warm in 70°F air and cold in 70°F water]

Evaluating
- determine [whether Polya's model or an alternative model is better suited to a specified application and explain your reasoning]
- critique [an article in the popular press related to the content of this course]
- select [one of several options for increasing production and justify your selection]

Creating
- formulate [an alternative to Polya's problem-solving model]
- design [an experiment to determine the effect of temperature on information retention]
- create [a problem involving material we covered in class this week]

Non-learning objectives: ... the student will
- know
- learn
- appreciate
- understand...

Critically important goals, but not directly observable and therefore not learning objectives.
Possible Scopes of Learning Objectives

- Complete course. Few, general—suitable to include on course syllabus. (See p. B9).
- Section of course. 1–2 pages, specific—suitable as study guide for an exam. (See p. B6).
- Individual lesson. 1–3 (maximum), very specific—put on board at the beginning of a lecture.

Taxonomies of Educational Objectives

Cognitive Domain\(^1\) (intellectual outcomes including knowledge, understanding, thinking skills)

- Remembering—Retrieving, recognizing, and recalling relevant knowledge from long-term memory
- Understanding—Constructing meaning from oral, written and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing and explaining
- Applying—Carrying out or using a procedure through executing or implementing
- Analyzing—Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing and attributing
- Evaluating—Making judgments based on criteria and standards through checking and critiquing
- Creating—Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning or producing

Affective Domain\(^2\) (emotional outcomes including interests, attitudes, appreciation)

- Receiving—attend to a stimulus [read a handout, listen attentively to a lecture]
- Responding—react to a stimulus [carry out an assignment, participate in a discussion, show interest in a subject]
- Valuing—attach value to an object, phenomenon, or behavior [demonstrate a positive attitude, appreciation, belief, or commitment through expression or action]
- Organization—organize (compare, relate, and synthesize) different values into the beginning of an internally consistent value system [recognize a need to balance freedom and responsibility, formulate a career plan, adopt a systematic approach to problem solving]
- Characterization by a value or value complex—internalize a value system and behave accordingly in a pervasive, consistent, and predictable manner [work independently and diligently, practice cooperation in group activities, act ethically]

Psychomotor Domain\(^3\) (motor skill outcomes including operating equipment, sports)

- Perception—use sense organs to obtain cues about motor activity [relate labels to need for special handling of dangerous materials]
- Set—readiness to take a particular action [explain steps required to operate a piece of lab equipment]
- Guided response—early stage of learning a performance skill including imitation and trial and error [consciously follow a prescribed instrument calibration procedure]
- Mechanism—later stage of learning a performance skill when it can be performed with proficiency [follow the same procedure smoothly and effortlessly]
- Complex overt response—skillful performance of a complex movement pattern [repair electronic equipment quickly and accurately]
- Adaptation—skills that are so well-developed that the individual can modify them to fit the situation [alter a routine procedure to adapt to a novel situation]
- Origination—creating new movement patterns based on highly developed skills [develop a procedure for building an experimental prototype]

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Bloom's Taxonomy of Educational Objectives: Cognitive Domain*

- Each skill involves the skills below it
- Usually, undergraduate education deals almost exclusively with Remembering, Understanding, and Applying.
- Ideally, all Bloom levels should be addressed in every course (need not be sequential).

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* Math curricula often neglected (5,6)
* How to assess?
Illustrative Detailed Objectives

**Example 1.** By the end of Chapter 4 of the course text, you (or “the student”) will...

*Unacceptable:* ...learn how to design and conduct experiments.
*Weak:* ...be able to design an experiment to measure *** and analyze the results
*Good:* ...be able to
  (a) design an experiment to measure *** as a function of *** (Creating) and perform an error analysis (Applying or analyzing)
  (b) explain in terms a bright high school senior could understand the meaning of the results (Understanding).
  (c) rate the applicability of different empirical correlations for *** vs. ***. (Evaluating)

**Example 2.** By the end of this course, you (or “the student”) will...

*Unacceptable:* ...understand the requirements of multidisciplinary teamwork.
*Weak:* ...be able to function effectively on a multidisciplinary project team.
*Good:* ...be able to
  (a) function effectively as a team member on a multidisciplinary project team, with effectiveness being determined by peer ratings and self-assessment (Applying & affective)
  (b) judge the relative importance of the different disciplines in the project (Evaluating)

**Reasons for Writing Objectives**

- **Identify & classify course material.** Use objectives as a basis to
  - construct syllabus
  - plan lessons
  - identify and delete obsolete or extraneous course material
  - make sure all Bloom levels are being addressed
  - minimize time spent in class on low-level material. *Suggestion: If Level 1 material is important, put it on a study guide for exams but don’t spend any time on it in class.* Reserve class time for things the students need a teacher for, not writing definitions to be copied and memorized.

- **Get constructive alignment** (Biggs) among lectures, activities, assignments, and exams. Avoid common disaster of teaching one thing and testing on something else; help assure that adequate practice and feedback is provided on high-level skills before the skills are assessed; make multiple sections of a course consistent.

- **Provide a study guide for students** (see next two pages). If you don’t give your objectives to the students, the course becomes an exercise in guessing what you think is important for them to know. If you give all of your objectives to the students on Day 1, they will never look at them again. Giving them as study guides for tests helps assure that the students will pay attention to them, and maximizes the likelihood that the students capable of meeting the objectives will end up doing so.

- **Tell faculty colleagues what they can expect students who pass this course to be able to do.**
  - teachers of follow-on courses, new instructors, adjunct instructors
  - curriculum planning committees
  - accreditation coordinators

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**What was Calc I - Calc II?**

- **what is success?**
  - **failures**

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**Mistakes in objectives**

- High level => Good School
- Assess at levels that are not taught.