

Creating and Using Effective Learning Goals

What is a learning goal?

An important first step in course transformation is to define explicit learning goals for each course. This is a key aspect of "backwards design," in which the end-result of instruction (the goals) are explicitly defined, driving instruction and assessment. Whereas a syllabus lists the topics that will be covered in the course, learning goals explicitly communicate the key ideas in terms of what students should be able to *do* with those ideas, and at what level.

Learning goals take the form: **"At the end of this course, students will be able to..."** followed by a specific action verb and a task. For each course, faculty typically define (1) five to ten course-level goals that convey the major learning themes and concepts, and (2) various topic-level learning goals (also called learning "outcomes" or "objectives") that are more specific and aligned with the course-level learning goals.

What are the benefits of writing learning goals?

Learning goals are a communication tool. Your goals indicate to your students, to other instructors, and to yourself what you expect of students in the course – both the level of their understanding, and what they should be able to do as a result of that understanding. This is useful in a variety of ways:

- Students know what they should be focusing on, making study time more productive
- Instructors find it easier to write homework, exams, and design instruction – and at an appropriate level
- Enables the creation of a more realistic syllabus that is not overly broad
- Instructors in subsequent courses know what they can expect that their incoming students will know
- Alignment between courses in a department becomes easier, allowing for a more coherent curriculum

Example learning goals

Below are examples of learning goals from an introductory genetics course at the University of Colorado, Boulder (CU) Molecular, Cellular, and Developmental Biology (MCDB) department and a 2nd year physics course in the University of British Columbia (UBC) Physics & Astronomy department. See link to SEI learning goals resources below for more examples.

"At the end of this course, students will be able to..."

Examples of learning goals from an introductory genetics course

Course-level learning goal:

Deduce information about genes, alleles, and gene functions from analysis of genetic crosses and patterns of inheritance.

Topic-level learning goals:

- a) Draw a pedigree based on information in a story problem.
- b) Distinguish between different modes of inheritance.
- c) Calculate the probability that an individual in a pedigree has a particular genotype or phenotype.
- d) Design genetic crosses to provide information about genes, alleles, and gene functions.
- e) Use statistical analysis to determine how well data from a genetic cross or human pedigree analysis fits theoretical predictions.

Examples of learning goals from a 2nd year physics course

Course-level learning goal:

Be able to argue that the ideas of quantum physics are true and that it is useful for engineers to know about them.

Topic-level learning goals:

- a) Given a simple physical system, be able to draw the relevant potential energy curve needed to model dynamical behaviour.
- b) Be able to explain the essential role of the quantization of light as demonstrated by the photoelectric effect in the operation of a photomultiplier tube, a solid state photodetector such as used in motion sensors, and the human eye.
- c) Be able to design an experiment for determining the composition of an unknown pure metal based on the photoelectric effect.
- d) For an unknown material, be able to analyze whether it is a conductor, insulator, or semiconductor, and then predict what electron energy distribution it must have.
- e) Qualitatively design a semiconductor diode that will only allow current to flow in one direction.

How do you create learning goals?

We have found that there is no substitute for discussion in the development of appropriate, attainable, clear learning goals. An individual faculty member developing goals for her course might consult with other instructors to discuss learning goals. In the best-case scenario, however, a faculty working group can be a powerful way to develop goals that reflect the values and engagement of the broad faculty community.

In the SEI programs, we have convened a working group composed of faculty members who have previously taught a course and those who teach subsequent courses. These working groups typically include a facilitator whose role is to review and synthesize materials, and create initial drafts of learning goals. Learning goals are drafted by discussing with faculty, as well as referring to materials used by instructors who previously taught the course, with emphasis on homework assignments, exams, and other materials that demonstrate what instructors want students to be able to do. Faculty members who teach subsequent courses communicate what they expect students to know coming into their course. The members of the working group discuss and revise these learning goals until a consensus list is generated, which for any instructor teaching the course would typically cover 70-80% of the class time.

What makes a good learning goal?

We recommend creating learning goals that convey the relevance and usefulness of any particular content to students. Use everyday language and applications when possible, and minimize the use of technical jargon. Many courses at CU and UBC include goals that focus a wide range of outcomes as well as cognition and understanding -- including skills, habits of mind, and affective outcomes such as: "Students should be able to justify & explain their thinking and/or approach to a problem or physical situation" or "Students should appreciate the value of physics as a way of making sense of the world."

One of the most critical aspects of writing learning goals is choosing a verb that describes exactly what students should be able to do. Many faculty are tempted to use the verb "understand," but this is not specific – two faculty members could both say "understand" but have completely different expectations as to what students should be able to do

It is also important to make sure that your learning goals are aligned with the level of learning that you actually expect of your students. A common problem is that instructors expect a higher-level of thinking of students than is actually supported by their instruction or exams (which typically are aimed at recall and comprehension). One tool for thinking about the different levels of learning Bloom's Taxonomy of the Cognitive Domain, which outlines different cognitive levels. Certain verbs are typically associated with different cognitive levels, and browsing these verbs can be helpful in developing learning goals at appropriate levels of challenge The table below shows levels of learning and examples of verbs that match each level, based on Bloom's taxonomy.

Levels of cognitive understanding and corresponding verbs

Level	Description	Representative Verbs
Knowledge	Remember & recall factual information	Define, List, State, Label, Name
Comprehension	Demonstrate understanding of ideas, concepts	Describe, Explain, Summarize, Interpret, Illustrate
Application	Apply comprehension to unfamiliar situations	Apply, Demonstrate, Use, Compute, Solve, Predict, Construct, Modify
Analysis	Break down concepts into parts	Compare, Contrast, Categorize, Distinguish, Identify, Infer
Synthesis	Transform, combine ideas to create something new	Develop, Create, Propose, Formulate, Design, Invent
Evaluation	Think critically about and defend a position	Judge, Appraise, Recommend, Justify, Defend, Criticize, Evaluate

Based on our experiences working with faculty to write learning goals, we formulated a checklist to help instructors create and critique learning goals (below). This can be helpful in creating an effective goal, and iteratively improving goals over time.

Checklist for creating learning goals:

- ✓ Does the learning goal identify what students will be able to do after the topic is covered?
- ✓ Is it clear how you would test achievement of the learning goal?
- ✓ Do chosen verbs have a clear meaning?
- ✓ Is the verb aligned with the level of cognitive understanding expected of students? Could you expect a higher level of understanding?
- ✓ Is the terminology familiar/common? If not, is knowing the terminology a goal?
- ✓ Is it possible to write the goal so it is relevant and useful to students (e.g. connected to their everyday life, or does it represent a useful application of the ideas)?

Writing learning goals pays off

Writing learning goals requires effort and time, but carries multiple benefits. Once defined, faculty use learning goals as they plan class time, develop homework, and create exams. As a result, all aspects of the course become better aligned, and focus on what faculty most want students to achieve. Faculty using learning goals report that writing high quality exam questions becomes easier. At CU and UBC, we have seen that the cognitive level of exams often increases as faculty align the questions with the higher cognitive level of the learning goals.

When faculty share the learning goals with students, students and faculty both find substantial benefit from the improved communication. Learning goals can be communicated to students in a variety of ways, including posting them online and beginning each lecture by presenting the relevant learning goals for the day. End-of-year surveys reveal that students are overwhelmingly positive about having access to learning goals. Students report the greatest benefit is that learning goals let them “know what I need to know,” which helps students focus on important ideas and study more effectively.

For departments, writing learning goals has informed, shaped, and aligned the departmental curriculum. By considering the learning goals from multiple courses, departments have discovered that some concepts were taught in an identical manner in multiple courses and other critical concepts were omitted entirely. As a result faculty members who teach different courses have begun to work together so that their goals complement each other and encompass what every student should be able to do by graduation. For instance, some fundamental evolution concepts were added to the MCDB curriculum after this process highlighted their absence.

Resources:

www.cwsei.ubc.ca/resources/learn_goals.htm – compilation of learning goals and other resources from the CU and UBC SEIs

“At the end of my course, students should be able to ...”: *The benefits of creating and using effective learning goals*, Michelle Smith and Katherine Perkins, *Microbiology Australia*, pp. 35-37, (March 2010).

http://microbiology.publish.csiro.au/?act=view_file&file_id=MA10035.pdf

What is the Value of Course-Specific Learning Goals?, Beth Simon and Jared Taylor, *Journal of College Science Teaching*, Vol. 39, pp. 52-57 (2009).

A Thoughtful Approach to Instruction: Course transformation for the rest of us, Stephanie Chasteen, Katherine Perkins, Paul Beale, Steven Pollock, & Carl Wieman, *Journal of College Science Teaching*, Vol. 40, pp. 24-30 (2011).