SECTION 2

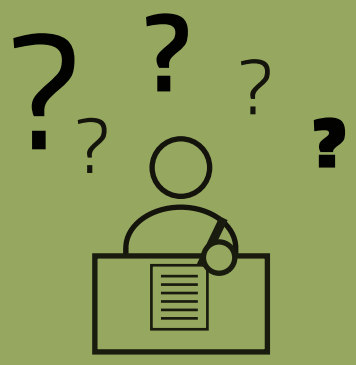
WRITING LEARNING OUTCOMES

3. Well-written Learning Outcomes
4. Writing Learning Outcomes Using KSAs

3

Well-written learning outcomes

SCENARIO



SPECIFIC AND ASSESSABLE LEARNING OUTCOMES

Helen had been periodically working with an educational developer to design a course. She had been asked to submit learning outcomes and the deadline was fast approaching. It was her 4th consultation with the educational developer and their conversation returned once again to the subject of learning outcomes. Exasperated, Helen said,"Why do we keep discussing and revising the learning outcomes? We have to hurry and create the course assignment."

The educational developer replied: "When I look at your learning outcomes from a student's perspective, I don't know what it is that you are going to assess me on or how. I am uncertain of what you want me to do." The educational developer suggested that Helen begin developing her main assignment so that they could get a better sense of what Helen actually wanted the students to do.

The next day, Helen returned. She brought in a course assignment that she had used in the past and had intended to adapt it for this course. The assignment was going to account for 60 percent of the student grade. It clearly communicated what the students were required to know and do and was broken down into logical sections and sequenced accordingly.

Together, they then began working backwards to write the learning outcomes and align them to the assignment.

Well-written learning outcomes communicate important messages about what students will be able to know, think, and do at the end of a course or program. The focus of this section is how to write specific and assessable learning outcomes at the course level: for instructors, they are a tool for thoughtful and deliberate course planning (Fink 2013); for students, they provide clarity and focus about what students are expected to learn and how they will be required to demonstrate it.

While this section focuses on learning outcomes that are assessable within a course, using the Knowledge, Skills and Attitudes (KSAs) framework and Bloom's Taxonomy to write and sequence learning outcomes is also applicable at the program level, including thesis-based programs. Making expectations explicit can help instructors, mentors, and students better understand the learning destination and thus plan and monitor strategies for getting there (Denecke et al., 2017).

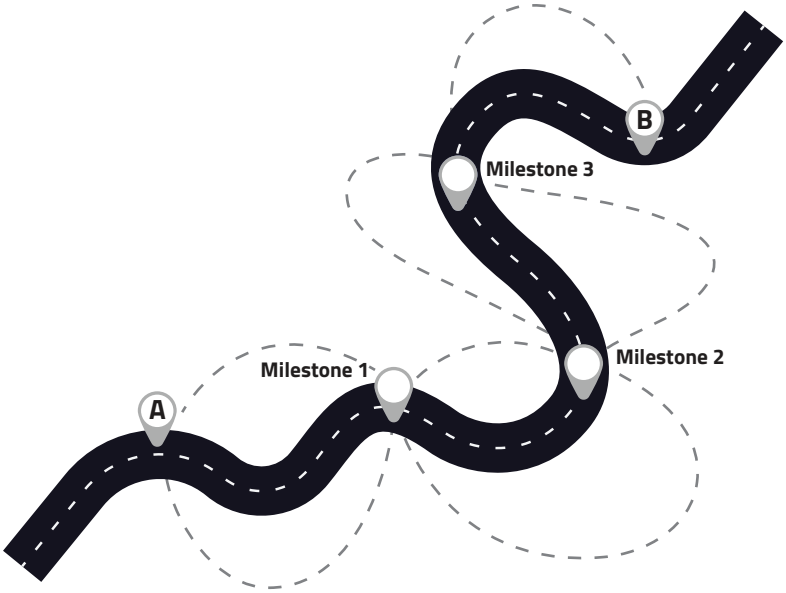


Figure 4. Learning outcomes form a road map to the final learning destination, with milestones along the way.

See section 1 of this guide for an introduction to learning outcomes, their definition, and important situational factors.

Well-written learning outcomes:

A. Define what students will be able to do in the time given (time-bound);

B. State the specific behavior that students are expected to demonstrate (using a measurable/assessable verb); and

C. Can be assessed.

This is illustrated in the example below:

TIP An outcome describes what you want students to DO with what they learn and implies how they will show you what they have learned.

EXAMPLE

B demonstrable verbs

Learning Outcome:

Select and evaluate reference materials and incorporate them appropriately into written assignments. } **A** what students do

C Some potential evidence could be:

- Students provide an annotated reference list including both academic and credible non-academic sources;
- Students incorporate appropriate citations within their written assignments;
- Students use citation formats correctly.

Further, well-written learning outcomes are SMART (Greenleaf, 2008):

S pecific.

M easurable (assessable, demonstrable).

A ttainable by students at current level and matched to purpose of the course.

R elevant for students, course, program and degree.

T ime-bound or can be completed in the time given.

COMPARING LEARNING OUTCOMES

EXERCISE

For the outcomes listed below, ask yourself:

- Does it define what students will be able to do in the time given?
- Does it state the specific behavior that students are expected to demonstrate (using an assessable verb)
- Can it be assessed?

Learning Outcome 1	Learning Outcome 2
Upon completion of this unit, students will be able to critically assess the factors influencing physical activity and nutrition (environment, community, habits, underlying thinking, lifestyle and time allocation), and analyze how these factors shape their current choices.	Upon completion of this unit, students will be able to understand how factors such as the environment and community impact their physical activity and nutrition choices.

Which outcome is more effectively written?

If you answered #1 you are correct!!!!

The verb "to understand" is not a measurable verb. It is not specific enough to tell students how they must ***demonstrate*** their "understanding" of the factors that shape choices related to physical activity and nutrition. Outcome 1 is more specific and measurable in stating that students must demonstrate their ability to critically assess each individual factor and ***analyze*** how it shapes their current choices.

Q1 WHAT ACTION VERBS SHOULD I AVOID USING?

A The Centre for Teaching and Learning at the University of Windsor recommends avoiding the use of "THE SINISTER SIXTEEN: Verbs that are passive, internal and/or otherwise unobservable" (Potter & Kustra, 2012).

The sinister sixteen are as follows:

Understand	Be aware of
Appreciate	Be conscious of
Comprehend	Learn
Grasp	Perceive
Know	Value
See	Get
Accept	Apprehend
Have a knowledge of	Be familiar with

http://www1.uwindsor.ca/ctl/system/files/PRIMER-on-Learning-Outcomes.pdf

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Writing learning outcomes using KSAs

Learning outcomes focus on the essential, transferable learning that can be observed and assessed in courses and programs. They support the attributes of an ideal graduate of a course program, and are reflective of disciplinary contexts. KSAs provide a useful framework for thinking about and describing this essential learning.

Knowledge - the types of thinking you want your students to act upon or the concepts, facts, and theories you want them to acquire.

Skills - the skills you want your students to be able to perform at a given level.

Attitudes - the feelings, values, appreciations, motivations, or priorities of your discipline or profession you want to stimulate in your students.

This framework maps better onto some disciplines and professions than others. It may also be helpful to consider Fink's (2003) taxonomy of significant learning, which represents a more holistic view of learning including domains such as metacognition (learning how to learn), and the human dimension (learning about oneself and others).

Figure 5. Taxonomy of Significant Learning (Fink 2003).

Other frameworks include "Ideas, Connections, and Extensions" (ICE) (Fostaty, Young, & Wilson, 2000) and the "Structure of Observed Learning Outcomes" (SOLO) (Biggs & Tang, 2007). Instructors and administrators can use aspects of each framework or taxonomy to plan and sequence intended learning outcomes, teaching and learning activities, assessments, and/or courses. Bloom's (1956) levels provide a useful vocabulary to articulate learning outcomes in terms of demonstrable verbs, and also describe a progression in levels of complexity.

Q1 WHAT IS BLOOM'S TAXONOMY OF LEARNING?

A

Bloom's taxonomy of learning has evolved over time (Anderson & Krathwohl, 2001) and is a tool commonly used to write learning outcomes. Dr. Benjamin Bloom (1913 - 1999) was an educational psychologist who in 1956, along with his team, developed a taxonomy of learning that classifies learning outcomes according to the following 3 domains:

NOTE There are a variety of taxonomies that can be used to classify student learning. Bloom's taxonomy is the most common and is therefore the one we have chosen to focus on.

Cognitive (Knowledge) - knowledge and intellectual development in your course.

Psychomotor (Skills) - physical movement and motor skills necessary to learn in your course.

Affective (Attitudes) - values, attitudes, appreciations, motivations, and priorities of the discipline or profession in your course.

For each domain, you can select from a list of measurable verbs. These verbs are measurable in the sense that they can be demonstrated by the learner and therefore they can be assessed. For each domain, measurable verbs are categorized and arranged on a spectrum from simple to complex, concrete to abstract. At the low end of the spectrum students are required to demonstrate low-level, introductory skills. At the high end of the spectrum, students are expected to demonstrate critical, creative, and complex thinking skills. For example, in the cognitive domain, students should progress from remembering and understanding to evaluating and creating.

The following table illustrates how learning outcomes are categorized according to the newly updated Bloom's Taxonomy.

COMPLEX

↑

SIMPLE

Cognitive (KNOWLEDGE)	Psychomotor (SKILLS)	Affective (ATTITUDES)
Creating	Naturalizing	Characterizing
Evaluating	Articulating	Organizing
Analyzing	Fine Tuning	Valuing
Applying	Manipulating	Responding
Understanding	Imitating	Receiving
Remembering		

For a breakdown of each domain, including a definition of each category, corresponding verbs, and examples go to (p. 40).

BRAINSTORMING KSAs

Brainstorm the knowledge, skills and attitudes that learners need in order to meet the overall goals of your course. Answer the following questions:

Knowledge (Cognitive) - *What types of thinking do you want your students to do or the knowledge you want them to acquire throughout your course?*

_____

_____

_____

_____

Skills (Psychomotor) - *What skills do you want your students to be able to perform and at what level?*

_____

_____

_____

_____

Attitudes (Affective) - *What feelings, values, appreciations, motivations, or priorities of your discipline or profession do you want to stimulate in your students?*

_____

_____

_____

_____

KSAs directly correspond to the 3 domains used to classify learning outcomes in Bloom's taxonomy of learning.

Q2 HOW DO I USE BLOOM'S TAXONOMY OF LEARNING TO WRITE A LEARNING OUTCOME FOR A SPECIFIC KSA?

A The main components of a learning outcome are (1) the measurable verb selected from Bloom's taxonomy and (2) the specific KSA you want students to demonstrate. The general structure of a learning outcome is as follows:

By the end of the course, students will be able to (measurable verb) **+** (the knowledge, skill, or attitude you expect them to acquire)**.**

OR

By the end of the module/unit/lesson, students will be able to (measurable verb) **+** (the knowledge, skill, or attitude you expect them to acquire) **+ by** (how they will apply their knowledge or skill/how you will assess their learning)**.**

In analyzing the example from p. 26,

☑ EXAMPLE

Upon completion of this unit, students will be able to critically assess the factors influencing physical activity and nutrition (environment, community, habits, underlying thinking, lifestyle and time allocation), and analyze how these factors shape their current choices.

we can find all the pieces of a well written learning outcome.

☑ STEM

By the end of the course, students will be able to:

☑ DOMAIN AND MEASURABLE VERB

Domain - Cognitive
Verbs - Assess and Analyse

☑ SPECIFIC KNOWLEDGE, SKILL OR ATTITUDE YOU EXPECT THEM TO DEMONSTRATE

(1) the factors (environment, community, habits, underlying thinking, lifestyle & time allocation).

(2) how these factors shape their current choices related to physical activity and nutrition.

TIP As a program progresses, support student learning from simple to complex, concrete to abstract. Select a range of verbs from across the spectrum, exercising both simple and complex skills. As courses increase in difficulty and complexity throughout a program, select verbs from the high end of the spectrum in order to build higher order thinking skills. Similarly, learning should be assessed in progressively more challenging ways. Similarly, assessments should be designed to capture progressively more challenging learning outcomes.

Cognitive Learning Domain - Definititions & Verb List

	Definition:	Output Verbs:	Evaluating example:
CREATING	developing a hypothesis; devising a procedure; inventing a product	build, compose, create, construct, design, develop, devise, formulate, generate, hypothesize, invent, modify, organize, plan, predict, produce	Can the student **generate** new products or ideas?
EVALUATING	distinguishing whether a process/product has internal consistency, inconsistencies or fallacies; detecting appropriate-ness of a procedure for a given task	appraise, assess, choose, compare, conclude, critique, check, defend, detect, evaluate, hypothesize,judge, justify measure, monitor, rank, rate, recommend, review, score, test, validate	Can the student **justify** a decision or course of action?
ANALYZING	distinguishing relevant from irrelevant; determining fit or function within a structure; determining point of view, bias and/or values of presented material	analyze, appraise, attribute, break down, coherence, compare, conclude, contrast, correlate, deconstruct, determine, differentiate, discriminate, dissect, distinguish, extrapolate, find, integrate, investigate, outline, separate	Can the student **differentiate** between fundamental parts?
APPLYING	applying or demonstrating knowledge in a routine or nonroutine task	apply, calculate, carry out, clarify why, compute, demonstrate, discover, execute, extrapolate, generalize, illustrate, implement, manipulate, make, predict, show, use, utilize	Can the student **use** the new knowledge in another situation?
UNDERSTANDING	changing from one form of representation to another; illustrating a concept; drawing conclusions, determining cause and effect	choose, cite, clarify, classify, compare, conclude, convert, describe, discuss, exemplify, explain, express, extrapolate, give an example, illustrate, infer, interpret, match, paraphrase, restate, respond, summarize, translate,	Can the student **explain** ideas or concepts?
REMEMBERING	retrieving information from short and long term memory	accumulate, arrange, define, describe, identify, label, list, locate, match, name, recall, recite, recognize, repeat, retrieve, state	Can the student **recall** information?

Adapted from
https://carleton.ca/edc/wp-content/uploads/TT-Writing-Learning-Out-comes.pdf

Cognitive Learning Domain - Example

Course Objective	**Student Learning Outcome**	**Levels of Cognition** **(See Bloom's Learning Domains: The Cognitive Domain)**		
		Low	**Med**	**High**
		Remembering and Understanding	**Applying and Analyzing**	**Evaluating and Creating**
Example: The purpose of Food Microbiology 361 is to acquaint students with pre and pro-biotics in the food industry	**Example:** Students will be able to explain the principles underlying the application of pre and pro-biot-ics in the food industry.	X Explain is a verb at the Understanding level of the Cognitive Domain		

Psychomotor Learning Domain - Definititions & Verb List

	Definition:	Output Verbs:	Evaluating example:
NATURALIZING	Automated, unconscious mastery of activity and related skills at strategic level	compose, delegate, design, devise, specify, manage, invent, plan, supervise, troubleshoot	Can the student **design** elements to meet strategic needs?
ARTICULATING	Adapting and integrating expertise to satisfy a non-standard objective	adapt, calculate, coordinate, combine, compile, construct, develop, edit, formulate, integrate, manipulate, modify, replace, repair, solve	Can the student **relate and combine** activities for the purpose of **developing** methods to meet novel requirements?
FINE TUNING	Making minor adjustments in the physical activity in order to perfect it.	adjust, calibrate, conduct, control, complete, demonstrate, install, operate, show, perfect, practice, present, simulate	Can the student **perform or demonstrate** with expertise?
MANIPULATING	Reproducing activity from instruction or memory	administer, apply, assist, assemble, build, carry out, collect, configure, contribute, draw, execute, fabricate, graph, implement, locate, measure, perform, re-create, select	Can the student **carry out** the task from instruction?
IMITATING	Attempted copying of a physical behavior	adhere, copy, duplicate, follow, replicate, repeat, trace	Can the student **repeat** the action/process/activity?

Adapted from
https://carleton.ca/edc/wp-content/uploads/TT-Writing-Learning-Out-comes.pdf

Psychomotor Learning Domain - Example

Course Objective	**Student Learning Outcome**	**Level of Psychomotor Skills (See Bloom's Learning Domains: Psychomotor Domain)**		
		Low	**Med**	**High**
		Imitating and Manipulating	**Precision and Articulation**	**Naturalization**
Example: Food Microbiology 361 engages students in the group processes of food scientists.	**Example:** By the end of the unit, students will be able to accurately measure quantities using scientific instruments such as the Vernier caliper, Geiger meter, and various scales.		X Measure is a verb used at the Manipulating level of the Psychomotor Domain.	

Affective Learning Domain - Definitions & Verb List

	Definition:	Output Verbs:	Evaluating example:
CHARACTERIZING	Acting consistently with the new value.	act, display, influence, internalize, integrate, relate, resolve, qualify, practice, verify	Does the student **practice** in accordance to their beliefs?
ORGANIZING	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities.	alter, arrange, build, codify, construct, compare, develop, discriminate, display, generalize, modify, order, organize, prioritize, reconcile	Does the student **state** beliefs and reasons?
VALUING	Showing some definite involvement or commitment.	argue, criticize, debate, decide worth, defend, devote, explain, join, justify, persuade, present, propose, pursue, refute, share	Does the student **express** opinions?
RESPONDING	Showing some new behaviors as a result of experience.	complete, contribute, comply, conform, cooperate, discuss, describe, examine, formulate, perform, provide other references/examples, react, respond, seek, use	Does the student **participate** actively?
RECEIVING	Being aware of or attending to something in the environment.	ask, accept, attend, acknowledge, concentrate, follow, give, identify, select, recognize, retain	Does the student **identify** ideas or concepts from an experience?

Adapted from
https://carleton.ca/edc/wp-content/uploads/TT-Writing-Learning-Out-comes.pdf

Affective Learning Domain - Example

Course Objective	**Student Learning Outcome**	**Levels of Affectiveness** **(See Bloom's Learning Domains: Affective Domain)**		
		Low	**Med**	**High**
		Receiving and Responding	**Valuing and Organizing**	**Characterizing**
Example: Food Microbiology 361 develops an appreciation of the application of large scale microbiological techniques.	**Example:** Students will be able to integrate their awareness of the real time application of large scale microbiological techniques into their own practice.			X Integrate is a verb used at the Characterizing by Value level of the Affective Domain.

EXAMPLE

TWO UNIQUE APPROACHES

The Chemistry Department at the University of Alberta is required to submit learning outcomes for every course for their unit review. In addition, the Department of Chemistry provides many of its courses to engineering students. As a result, these courses need to meet the accreditation requirements as set forth by Canadian Engineering Accreditation Board and therefore require measurable learning outcomes.

The Department of Chemistry began by developing learning outcomes for:

- Chemistry 101 and 103 (Engineering equivalent of 101), and
- Chemistry 102 and 105 (Engineering equivalent of 102).

In each course, there is an inherent progression and sequencing of course content: beginning with atoms, moving to molecules, then to gases, liquids, and solids, etc. Among faculty there is a common and underlying agreement as to what needs to be taught in the course.

In setting out to define learning outcomes, faculty took two distinct approaches:

APPROACH 1 - "BOTTOM UP" CHEMISTRY 101/103 AND CHEMISTRY 102/105

Christie took what she describes as a bottom up approach. Christie began developing learning outcomes by first examining the Engineering competencies and identifying and drafting a list of the knowledge and skills that enabled students to meet these competencies.

Yoram, a colleague within the Department then attended a session offered by the Centre for Teaching and Learning on how to write learning outcomes and further refined Christie's list making the learning outcome measurable and specific; clearly defining what they required learners to do. Together, they articulated course level objectives and unit level outcomes.

APPROACH 2 - "AUDIT" CHEMISTRY 103

Arthur, on the other hand, examined the process Alberta Education had used to determine the KSAs required for Chemistry 20 and 30. Arthur sought to build on the skills and knowledge gained by students in Chemistry 20 and 30. To do this, he completed a thorough audit of all of his course materials, including lecture notes, assignment and assessments, identifying all of the knowledge, skills and attitudes he expected learners to come away with. Based on the KSA's identified, Arthur developed a detailed course map. For each unit of learning, Arthur provided:

- Name of the unit;
- Themes explored;
- An overview that lists the specific courses (and units) to which the unit connects;
- The key concepts covered;
- General outcomes; and
- Specific outcomes listed for each general outcomes.

To view a sample of Arthur's course map go to (p. 34).

Department of Chemistry

The course map that Arthur developed for Chemistry 103 is based on the work of Alberta Education's curriculum of documents and takes an in-depth approach to curriculum mapping. At the time that Arthur shared this, it was still a work in progress. The following example is only a segment of an entire course map totalling 9 pages in length. Such level of detail may be helpful for instructors who are planning unit and lesson-level teaching and learning activities, but are not necessary at the course (syllabus) or program level, where the focus would be on the general outcomes i.e. higher order thinking and application skills.

Unit A. Atoms

Themes: The structure of atoms and its relation to chemical periodicity

Overview: Atoms form the foundation of all matter. Their detailed structure and in particular, the arrangements of electrons, can be related to the atomic, physical, and chemical properties of all elements in the periodic table. However, the simplistic view that electrons always behave as particles must be abandoned, and this must be superceded by a more powerful model – quantum theory – which provides a more accurate description of the structure of atoms.

This unit builds on:
- Chemistry 20, Unit A The diversity of matter and chemical bonding

This unit provides a background for:
- Chem 161, Unit X
- Chem 241, Unit X

Unit A requires approximately 25% of the time allotted for Chem 103.

Key concepts:
- electromagnetic spectrum
- quantization of energy
- photons
- line spectra, Bohr model
- ground and excited states
- wave-particle duality
- de Broglie wavelength
- uncertainty principle
- wavefunctions and orbitals
- probability distribution
- quantum numbers
- electron configurations
- effective nuclear charge, shielding and penetration
- Hund's rule, Pauli exclusion principle
- core and valence electrons
- periodicity
- atomic radii, ionization energy, electron affinity
- diamagnetism and paramagnetism.

General outcome 1. Appreciate the nuanced distinction between matter and energy.

Specific outcomes for knowledge:
A1.1k Recall the nuclear model of an atom and apply it to describe the subatomic structure (numbers of electrons, protons, and neutrons) of any isotope of an element in the form of a neutral atom or an ion.
A1.2k Become familiar with the periodic table, learn the names and symbols of elements, and distinguish between atomic number and atomic mass.
A1.3k Name and write formulas of ionic compounds (including those containing polyatomic ions) and covalent compounds (including simple binary and oxyacids); recall assignment of oxidation numbers.
A1.4k Identify different regions of the electromagnetic spectrum,
A1.5k Describe the experimental evidence for the quantization of energy and light.
A1.6k Relate energy, wavelength, and frequency of light viewed in the form of photons.

Q3 WHICH APPROACH IS BEST FOR WRITING COURSE-LEVEL LEARNING OUTCOMES?

A

For some, approaching the development of learning outcomes by brainstorming knowledge, skills, or attitudes may be a good starting point. However, it is not always necessary. One instructor might begin by identifying enduring understandings they want their students to have, while another might feel more comfortable analysing their existing assessments or lecture notes. An instructor who has already written careful rubrics for their assessments has, in a sense, already articulated their learning outcomes and may simply need to write them as clear statements.

On the other hand, in writing learning outcomes, an instructor may realize their their supporting lectures, classroom activities, or course materials need to be revised, restructured, reordered or refined to better assist students in meeting the goals of the course.

EXERCISE

TRY IT

1. **Identify a knowledge, skill or attitude you require students to demonstrate in your course.**

2. **Using the following template, try writing one of your own learning objectives for the selected knowledge, skill or attitude.**

By the end of the _____, students will be able to (measurable verb) + (the knowledge, skill, or attitude you expect them to acquire).

_____

_____

_____

_____

3. Double check your work

Ask yourself if it is:

S pecific.

M easurable (assessable, demonstrable).

A ttainable by students at current level and matched to purpose of the course.

R elevant for students, course, program and degree.

T ime-bound or can be completed in the time given.

QUESTIONS TO THINK ABOUT

EXERCISE

We have explored several approaches to writing learning outcomes.

Which approach are you more comfortable with and why?

_____

_____

_____

_____

What types of support might you need when writing learning outcomes?

_____

_____

_____

_____

TYING IT ALL TOGETHER

Lessons Learned

Through the process, the Chemistry Department faculty members realized that they were already teaching the knowledge and skills that students would require as professionals in their field. As Christie described it, writing learning outcomes was a matter of articulating what was already happening with respect to student learning in their department. To their own surprise, faculty realized that they were already teaching many of the "soft skills" (attitudes) that are often difficult to teach and assess.

Arthur identified two main challenges that faculty face with respect to the writing of learning outcomes:

- Knowing how to write learning outcomes effectively; learning the language that is used and what is meant by a measurable verb.
- The time required to write effective learning outcomes. When all was said and done, it took Arthur two days to develop his course map.

Ultimate Goal

The ultimate goal of the Department of Chemistry is to develop a curriculum map for the entire program of studies; a map that clearly (1) delineates the learning outcomes for each course, (2) illustrates how the learning outcomes are scaffolded from one course to another, and (3) indicates where there is strategic repetition/overlap between courses to address particularly challenging concepts. The next section of this document gives examples of mapping assessments to course learning outcomes and program level outcomes.

Also see:
SECTION 1. Definitions and Considerations
SECTION 3. Making Learning Outcomes Matter: Designing and Revising Courses Using Learning Outcomes
SECTION 4. Program Level Outcomes