Program Student Learning Outcomes
Mapping the Way Forward

A Program SLO Institute

Presented by Cosumnes River College
May 2005
Introduction:

This model of Program Student Learning Outcomes is based on the following definition: “A collegiate program is a group of related courses or other activities that align with a cohesive set of student learning outcomes”. The process of defining programs and developing the aligned student learning outcomes includes developing statements of the roles of the program and the common content themes, general skills, and typical assessment tasks occurring in program activities. These ideas inform the development of the overall program student learning outcomes, assessment measures, response plan, and course/activity alignment grids.

Student learning outcomes as used in this model are broad statements of the most important skills and abilities that students will take with them from our programs. The student learning outcomes are broad, however they are linked to more specific measurable objectives.

The materials provided for this institute are meant as a starting point for the development of program SLOs. The packet of materials represents our current understanding of a developing process, and as such is always to be considered in “draft” mode.
Identifying a “program”

Historically, we have identified programs either by looking at a list of degrees and certificates or by grouping related academic disciplines. We are moving to a more functional identification of programs of study that result in specific student outcomes. A “program” is a set of courses or other activities that can be aligned with a cohesive set of goals and outcomes for students.

Clearly, obtaining a degree or certificate is a type of student outcome, and so we will retain many of our traditionally identified programs. However, “programs” that consisted of groups of more-or-less related departments may want to revisit how the program is defined. Is there a cohesive set of outcomes that works for the entire group of departments? If not, perhaps some rethinking is needed. This is not to suggest that related departments can’t link up as one program, just that we need to think about the outcome set when making this decision.

In addition, there may be coherent programs that do not lead directly to degrees or certificates. Some of these will be identified departments at the College. For example, there is no current CRC degree or certificate in “History”. Nonetheless, there is a group of courses that could clearly align with a set of student learning outcomes. In another example, “Counseling” is clearly a program with respect to being able to identify student outcomes, but is not associated with any particular degree or certificate.
Defining a program functionally.

Begin by thinking about this question: What are the roles of your program in the broader context of the college? Here, “roles” is defined broadly as the functions of the program with respect to the students and the college.

With respect to the students the question is “why do students participate in your program?”. Why do they take your classes? Why do they participate in other activities in the program? For example, students take courses in Biology for three major reasons: to transfer to a four-year school in a biology-related major, to work toward more immediate employment in health care (e.g. as LVNs), or to fulfill GE requirements.

With respect to the college the question is “how does your program align with the overall goals and outcomes of the college?” CRC is currently developing a statement of college-wide student learning outcomes. Each program on campus supports some aspect of those outcomes. For example, one of the college-wide SLOs is the expectation that students will become self-reliant learners, another reflects the college's goal that students become informed citizens of a diverse society and yet another is related to the development of critical thinking and competencies. Look at a draft of the college-wide SLOs when defining the roles of your program...no doubt you fit into one or more of them.
Defining a programs common elements:

When preparing to write program SLOs, it is useful to consider the elements that are shared across many of the courses/activities within the program.

- **Common content themes:** Many of the courses or activities within a program will reflect the same broad content themes or ideas. For example, many Biology classes may include content related to the functioning of cells, many Art courses may include content related to the importance of color and line, many Library activities may include content related to use of online information sources, etc. These common themes suggest areas that are of broad and significant importance for student learning.

- **General skills:** Many of the courses or activities within a program may share an emphasis on the development of related skills, perhaps at increasingly sophisticated levels. These common skill sets suggest areas that are of broad and significant importance for student learning.

- **Typical assessment tasks:** It is useful to compare and contrast the typical assessment tasks within the program. In some cases, it may be important that similar tasks and scoring rubrics are used in sequential courses. In other cases, it may be important that
different activities or courses develop the students’ ability to respond to multiple assessment measures.

Defining the overall expectations of the program

Before developing specific SLOs for the program, it is helpful to ask what the 3-5 overreaching expectations are for the program and it’s students. What are your goals for your students? What do you expect them to experience as part of your program? Another way to think about this is to ask what the major goals of the program are if is working in an ideal fashion. What are your hopes for your students?

When writing the outcomes, remember that you may want to think about the expectations of the broader world “out there”. What do the “receivers” of our student expect? If the students are leaving here for immediate employment, what skills are they expected to arrive with on the first day of the job? If students are transferring from here to a four-year school, what skills will they need in their classes after transfer. Some external institutions (e.g. IMPAC, transfer schools, accrediting agencies, advisory groups, etc.) may provide direct information on the skills and/or knowledge expected from our students. These should definitely be considered when writing program SLOs. For example, if many of the students in a CRC program transfer to CSUS, the CRC program SLOs should
make it clear that our transfer students are prepared to succeed at CSUS. This is a chance to strengthen our relations with transfer institutions and employers.

**Writing the outcomes**

This is the nuts and bolts of the process. Look at everything stated to this point and write about 4-8 significant student learning outcomes for the program. SLOs answer the question “what will they be able to do out there based on what they have learned here?” Broader in scope than “objectives”, SLOs describe the major outcomes – things that a successful student will take away from the class for use in his/her future life. Objectives can be listed under each outcome to provide details.

For each SLO:

- In a sentence, describe a major application of knowledge that successful students will gain from the program.
- Consider the skills and abilities needed after the student leaves your program… on the job, after transfer, etc.
- Focus on the big picture for the SLOS. You can use objectives to describe more specific skills.
- Remember that you can include three kinds of abilities: cognitive (critical thinking), psychomotor (proficiently conducting specific
motor tasks), and affective (evaluating ethical situations and making value judgments).
Writing the assessment measures and response plan

SLOs include information on how the skills/abilities will be assessed by the faculty in the program. You may want to list the assessment methods and response plan for each SLO individually, or you may be able to list a set of assessment measures and response steps that apply broadly to all of the SLOs in your program. You should consider using the “usual” types of assessments that occur in your courses or activities (e.g. exams, projects, papers, portfolios, performances, etc.). These can be graded or non-graded. Also consider adding some assessments beyond what you usually do…perhaps a survey of students, a capstone project, or a study of how your students do after transfer or on the job. Think both inside and outside of the “box”. Be sure that the assessment methods are practical, that they measure what you intend them to measure (assessment validity), and that they would give the same results if administered to two similar groups (assessment reliability).

Our Program SLOs also include or refer to a plan to respond to that assessment and “close the loop” by revising the way the program functions. What will you do with the information that you gather concerning student learning? How will you make meaningful changes if you find that students are not achieving a desired outcome? Consider using the information to inform your: program review, curriculum
development, revision of course outlines, training and mentoring of new staff, professional development activities, and self-studies.

Looking at course/activity alignment with the outcomes

Once the SLOs have been written it is time to check and see how your courses or activities align with them. What courses/activities emphasize each SLO? One way to do this is to use a grid set up as shown:

<table>
<thead>
<tr>
<th>SLO Reflected in:</th>
<th>SLO 1</th>
<th>SLO 2</th>
<th>SLO 3</th>
<th>SLO 4</th>
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<tbody>
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<td>Course 1</td>
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<td>Course 2</td>
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<td>Activity 1</td>
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You may wish to indicate if the SLO is a major or minor part of each course or activity. You may also want to indicate in which course or activity the skill is initially developed and in which it is extended and strengthened.
Draft Student Learning Outcomes for the CRC

Biology Program: An Example

Roles of the program:
1. Prepare students in biology-based majors to be successful following their transfer to university programs.
2. Prepare students in biology-related occupational degrees and certificates (e.g. Allied Health, Nursing, etc.) for career success.
3. Assist GE students in developing an understanding of the modes of inquiry and basic content of the discipline.
4. Assist students in developing the ability to utilize the scientific method of inquiry, to find and comprehend information relating to biological issues, and to apply that knowledge to their “real lives”.
5. Assist students in moving toward becoming self-reliant learners, willing to engage intellectual inquiry.

Common content themes:
- The functioning of cells, including energy metabolism and cell division.
- The mechanisms by which organisms (including humans) maintain homeostasis
- The biochemistry of proteins and other biological macromolecules
- Patterns of inheritance and the functioning of genes
- The unity and diversity of organisms
- Evolution and the adaptation of organisms to the environment
- The scientific method

General skills:
- Use of the scientific method to solve problems
- Ability to express biological ideas clearly and concisely
- Proficient use of laboratory techniques
- Efficient problem-solving techniques
- Analysis and critical thinking skills
- Apply knowledge of theory to real world situations
- Gather and evaluate information from multiple sources

Typical assessment tasks:
- Written expressions including term papers, lab reports, analysis of data, etc.
- Use of laboratory equipment and techniques as shown in lab and on lab practical “exams”
- Answering exam questions clearly and concisely, demonstrating critical thinking skills
- Solving problem sets
- Developing clear questions and demonstrating critical thinking during class discussions
- Creative projects and/or inquiry projects
Overall expectations of the Program. We expect that:

1) Students transferring to four-year colleges in biology-based majors will have the knowledge and skills needed to succeed in upper division courses.

2) Students moving toward occupational degrees or certificates in biology-related fields will have the skills and knowledge to complete their training successfully.

3) Biology students in GE classes will develop the skills and knowledge that allow them to value and utilize scientific reasoning, access information on biological topics, and apply that information to personal and community issues.

4) Students will experience a rich, encouraging, and challenging learning environment which enables them to become self-reliant life-long learners.

General Learning Outcomes and Objectives

Students will be able to:

1) Demonstrate understanding of the processes of science, the scientific method, and the relationship between scientific research and established knowledge. This includes the ability to:
   • Recognize the way in which research leads to generally accepted conclusions and the integration of new research data with the building of a body of scientific knowledge.
   • Recognize that the information presented in science textbooks and other established “authorities” is the result of research conducted in the field or the lab and is based on an accumulation of data.
   • Design a scientific inquiry, including use of proper controls and analyses.
   • Demonstrate critical thinking skills shown by the analysis of data sets, recognition of the implications of perturbations to biological systems, and synthesis of information to draw conclusions.

2) Express themselves clearly when writing or speaking about biology, demonstrating knowledge of basic biological terminology and understanding of major biological concepts. This includes the ability to:
   • Produce laboratory reports which address background information, procedures, results, and analysis of data developed during a laboratory exercise or inquiry project.
   • Write essays explaining biological processes in clear and concise terms.

3) Demonstrate both content knowledge and test taking skills when completing essay, objective, and multiple choice exams. This includes the ability to:
   • Analyze the logic of a multiple-choice question and choose the correct response from among related items.
   • Write clear responses to essay question prompts without including extraneous information or omitting information necessary to provide a clear answer.
   • Utilize test-taking skills such as critical analysis of information, test-time management, and focused writing.
   • Demonstrate content knowledge in the broad areas of biology including cell biology, anatomy, physiology, molecular and transmission genetics, ecology, evolution. Note: See “content-related SLOs” for further development of these outcomes.
4) Use appropriate laboratory techniques proficiently. Specific techniques to be mastered will depend on the goal of the student as shown below:

- Biology majors lab techniques include:
  - Measurement (use of metric measures)
  - Microscopy
  - Pipetting
  - Gel electrophoresis
  - Dissection
  - Basic biochemical techniques such as pH testing, Biuret test, Benedict’s test, etc.
  - Ability to design a laboratory experiment, including the use of adequate controls and data analysis
  - Additional laboratory techniques relevant to biology majors can be found in the SLOs for the chemistry and physics courses required for this major.

- Pre-nursing majors lab techniques include:
  - Measurement (use of metric measures)
  - Microscopy (including histology)
  - Identification of unknown microorganisms
  - Staining of bacteria
  - Use of equipment used to gather physiological data on humans
  - Additional laboratory techniques relevant to pre-nursing majors can be found in the SLOs for the chemistry courses required for this career option.

- GE biology students lab techniques
  - Microscopy
  - Ability to conduct a simple laboratory experiment, given procedural information

5) Evaluate biological data, draw reasonable conclusions, recognize the ethical implications of these conclusions, and apply these conclusions to personal, community, and scientific problems. This includes the ability to:

- Choose what data to collect in order to address a specific hypothesis
- Collect data and keep organized records
- Analyze basic graphical and statistical analysis of data
- Reach and clearly express logical conclusions based on biological data
- Relate, in presentations and/or in written reports, how biological information is relevant to personal and community issues
- Recognize the ethical implications of biological research and the responsibility to use knowledge wisely

6) Employ information-gathering tools when using the scientific methods to investigate biological ideas. This includes the ability to:

- Use the Internet in order to gather scientific information, including the ability to recognize the relevance and scientific validity (or lack thereof) of information when found.
- Use the library in order to gather scientific information, including the ability to recognize the relevance and scientific validity (or lack thereof) of information when found.
<table>
<thead>
<tr>
<th>Expectations</th>
<th>Learning outcomes</th>
<th>Assessment measures</th>
<th>Response Plan</th>
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<tr>
<td><strong>We expect that:</strong></td>
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<td>5) Students transferring to four-year colleges in biology-based majors will have the knowledge and skills needed to succeed in upper division courses.</td>
<td><strong>Students will be able to:</strong></td>
<td>Learning will be assessed by:</td>
<td>Information will be used to:</td>
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<tr>
<td></td>
<td>a. Demonstrate understanding of the processes of science, the scientific method, and the relationship between scientific research and established knowledge.</td>
<td>• Term papers, guided discussion, student-led discussion, student presentation and/or lab reports will demonstrate clarity of expression.</td>
<td>• Inform the Biology Program Review</td>
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<tr>
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<td>b. Express themselves clearly when writing or speaking about biology, demonstrating knowledge of basic biological terminology and understanding of major biological concepts.</td>
<td>• Performance on exams will demonstrate content knowledge and test-taking skills</td>
<td>• Guide the revision of course outlines for existing courses and the development of new course outlines</td>
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<td>c. Demonstrate both content knowledge and test taking skills when completing essay, objective, and multiple choice exams</td>
<td>• Direct observation of student lab work and lab practical exams will show proficiency with lab equipment.</td>
<td>• Update and revise syllabi and potentially change the methods of instruction and methods of evaluation used in specific courses.</td>
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<td>d. Use appropriate laboratory techniques proficiently (microscopy, pipettes, gel electrophoresis, histology, dissection, etc.). Specific techniques to be mastered depend on the goal of the student (GE, biology major, pre-nursing major, etc.)</td>
<td>• Term papers, exams, lab reports, student-led discussion, guided discussion, and/or creative projects will allow students to demonstrate data analysis, use of information tools, problem solving ability, and critical thinking skills.</td>
<td>• Guide budgeting decisions with respect to laboratory equipment</td>
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<td>e. Evaluate biological data, draw reasonable conclusions, recognize the ethical implications of these conclusions, and apply these conclusions to personal, community, and scientific problems.</td>
<td>• Informal discussions with students and more formal student evaluation of the program will allow assessment of the affective affects of student experience.</td>
<td>• Assist biology faculty in self-evaluation, which may be reflected in the self studies</td>
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<td>f. Employ information gathering tools when using the scientific methods to investigate biological ideas.</td>
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<td>• Guide the mentoring of new faculty, both adjunct and full time</td>
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Content-related SLOs for Biology Majors (based on IMPAC outcomes)

**Diversity -**
1. Identify major groups of organisms and arrange them taxonomically
2. Describe and identify structures and explain their functions.
3. Determine phylogenetic relationships among organisms based on characteristics
4. Compare and evaluate different phylogenetic schemes.

**Ecology**
1. Characterize interactions among organisms and between organisms and environment
2. Discriminate among populations, community and ecosystem level interactions
3. Evaluate human impact on ecological systems

**Evolution**
1. Outline the major events in evolutionary history of life
2. Explain the principles and mechanisms of evolution
3. Characterize evolution at multiple levels of biological organization

**Genetics -**
1. Explain the organization, regulation and transmission of genetic information at the molecular level.
2. Analyze patterns and mechanisms of heredity
3. Analyze and calculate allele frequencies in populations over time.

**Cell Biology -**
1. Identify and describe cell structures and explain their functions.
2. Compare and contrast the processes of cellular reproduction in prokaryotes and eukaryotes.
3. Identify mechanisms of inter- and intracellular communication

**Biochemistry -**
1. Memorize structure of representative biological molecules and relate them to their function.
2. Describe the structure and function of enzymes in relation to metabolic pathways
3. Describe catabolic and anabolic pathways and relate them to organismal function and bioenergetics.

**Anatomy and Physiology**
1. Describe in detail the major structures of organ systems of humans or other organisms
2. Elucidate the general functions of organ systems of humans or other organisms
3. Describe the physiological and cellular mechanisms used by organisms to maintain homeostasis
Content-related SLOs for GE Biology students

Diversity -
1. Identify major groups of organisms and arrange them taxonomically.
2. Describe and identify structures and explain their functions.

Ecology
1. Characterize interactions among organisms and between organisms and environment.
2. Discriminate among populations, community and ecosystem level interactions.
3. Evaluate human impact on ecological systems.

Evolution
4. Explain the principles and mechanisms of evolution by natural selection.
5. Describe general patterns of macro-evolution.

Genetics -
1. Explain the transmission of genetic information at the molecular level.
2. Analyze patterns and mechanisms of heredity.

Cell Biology -
1. Identify and describe cell structures and explain their functions.
2. Briefly describe the overall processes of photosynthesis and respiration.
3. Characterize the processes of cellular reproduction in eukaryotic cells.

Biochemistry -
1. Recognize representative biological molecules and relate them to their function.
2. Describe the function of enzymes.

Anatomy and Physiology
1. Describe the major structures of animal and/or human organ systems.
2. Characterize the general functions of animal and/or human organ systems.
3. Describe the physiological processes that maintain homeostasis in the human body.

Content-related SLOs for Allied Health (Career) Biology Students

Genetics -
1. Explain the transmission of genetic information at the molecular level.
2. Analyze patterns and mechanisms of heredity.

Cell Biology -
1. Identify and describe cell structures and explain their functions.
2. Explain the structure and function of human tissues.
3. Characterize the processes of cellular reproduction in human cells.

Biochemistry -
1. Recognize representative biological molecules and relate them to their function.
2. Describe the function of enzymes.

Anatomy and Physiology
1. Describe the major structures of human organ systems.
2. Characterize the functions of human organ systems.
3. Describe the physiological processes that maintain homeostasis in the human body.
### General SLOs: Alignment of level of proficiency to courses

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>1. clear expression of biological info.</th>
<th>2. demonstrated knowledge and test taking skills</th>
<th>3. proficiency at lab techniques</th>
<th>4. Evaluate data and draw relevant conclusions</th>
<th>5. information gathering and problem solving</th>
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Note: Independent studies, honors, and experimental courses not included in this table.

I = Skill expected at beginning level,
A = Skill expected at advanced lower division level,
D = Skill further developed through additional practice and analysis
### Biology Content Related SLOs: Alignment of Courses to Outcomes:

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>diversity</th>
<th>ecology</th>
<th>evolution</th>
<th>genetics</th>
<th>cells</th>
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<td>350 (environ.)</td>
<td>L</td>
<td>M</td>
<td>L</td>
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<td>366 (tox)</td>
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<tr>
<td>390 (nat.hist.)</td>
<td>M</td>
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<td>L</td>
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<td>462 (genetics)</td>
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<td>470 (behavior)</td>
<td>M</td>
<td>M</td>
<td>M</td>
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<td><strong>Career</strong></td>
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<tr>
<td>102 (A&amp;P)</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>L</td>
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<tr>
<td>430 (A&amp;P)</td>
<td>0</td>
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<td>L</td>
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<tr>
<td>431 (A&amp;P)</td>
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<td>0</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>M</td>
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<tr>
<td>440 (micro)</td>
<td>0</td>
<td>0</td>
<td>L</td>
<td>L</td>
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</tbody>
</table>

M = major component of course  
L = lesser component of course  
(note: coverage at the majors level is more sophisticated than is coverage at the GE level)
“SLO GLOSSARY”

Some definitions useful in developing Student Learning Outcomes at CRC
(M Buechner 2004)

Student Learning Outcomes (SLOs)

- An SLO is a general statement of the measurable skills and abilities a student will possess upon successfully finishing a course of study. It includes or refers to a plan to incorporate feedback and “close the loop” by changing the course of study. Broader in scope than “objectives”, SLOs focus on the important general abilities a successful student will take away from the class, program, or college for use in his/her future life.

- **Course SLO:** A general statement of the skills and abilities a student will possess upon successfully finishing a course.
  - **Examples**
    - Non-majors biology course: When given data from a scientific report, for example as reported in a newspaper, the student will be able to draw reasonable conclusions and apply the information to personal and community issues.
    - Computer applications course: The student will be able to choose the appropriate software application to use in a variety of situations and will use that application with precision.

- **Program SLO:** A general statement of the skills and abilities a student will possess upon successfully finishing a program.
  - **Examples**
    - Honors Program: The student will be able to research difficult issues and questions that arise within the disciplines studied and arrive at thoughtful conclusions based on that research.
    - GE Program: The student will be able to utilize the basic methods of the discipline studied and apply those tools to personal and community issues.
    - AS in Psychology: The student will be able to analyze patterns of human behavior, developing thorough and complex explanations consistent with the major psychological perspectives.
    - Tutoring Program: Students in basic skills classes will find accessible and prepared tutors through the tutoring program.

- **College-wide SLO:** A general statement of the skills and abilities a student will possess upon successfully graduating from a college.
  - **Examples**
    - Overall college experience: During the process of attending the college will experience a rich and positive learning experience and will become more able to contribute to the well being of the community.
    - Cultural competence: A graduate of the college will demonstrate abilities such as intercultural communication skills, awareness of cultural diversity, and active avoidance of cultural bias that enhance success in a society that is diverse socially and culturally.
Course or program objective
A course objective is a statement of what things a student will be able to do upon successfully finishing a course or program. More narrowly focused than an SLO, course objectives are directed toward specific tasks. Course objectives can be found on our course outlines. They finish the sentence “Upon successful completion of this course the student will be able to…”
- Examples: Biology course: Solve problems in Mendelian genetics using both Punnett Squares and probability calculations.
- Computer applications course: enter data into Excel and produce clear graphs.

Alignment grid
An alignment grid is a table showing how parts of a course of study fit together with one another. Such a grid may include course objectives, student learning outcomes, methods of instruction, methods of evaluation, course themes, etc.

Taxonomies
In the context of SLOs, a taxonomy is a classification of skills and abilities based on level of achievement. The levels move from very simple processes to very complex ones.
- Cognitive taxonomy: A classification of cognitive skills and abilities ranging from relatively simple tasks such as recognition to very complex processes such as critical analysis.
- Psychomotor taxonomy: A classification of physical (motor) skills and abilities ranging from relatively simple imitation to creative mastery of a physical skill.
- Affective taxonomy: A classification of skills and abilities that relate to values and emotions; levels range from relatively simple recognition of value to complex processes such as critical evaluation of ethical situations.

Rubric
A description of the criteria which will be used to grade student work or activities and the grading scheme based on these criteria.
- Analytical rubric: A rubric specifying many traits which will be evaluated; the score on each trait will be added to produce the overall grade for the work or activity
- Holistic rubric: A rubric that provides holistic descriptions of the type of work producing each grade level (A-F)

Evaluation
For our purposes, we define evaluation as any process that measures student skills, knowledge, and abilities and informs the grade that the student receives in the course. The term “assessment” is used in a similar way, but for the purposes of simplicity, and because we list “methods of evaluation” on our course outlines, we will stick with “evaluation”.

Formative evaluation
Formative evaluation is conducted early in the learning process when mastery of the skill or concept is not yet expected.

Summative evaluation
Summative evaluation occurs after the learning process is essentially complete and mastery of the skill or concept is expected.
Norm-referenced evaluation
In norm-referenced evaluation the grade is based on the score distribution within the group; also called "curved" grading.

Criteria-referenced evaluation
In criteria-referenced evaluation the grade is based on previously criteria specified and is not affected by the score distribution within the group (i.e. the grade is not "curved" to the class norm)

Multiple measures
“Multiple measures” is a term used to reflect the use of a variety of methods to evaluate student work and produce a grade. For example, portfolios, participation, projects, direct observation of skills performance, etc., may all be used in addition to more traditional exams and papers.

Validity of evaluation
The validity of evaluation is the extent to which the evaluation actually measures what it is intended to measure. For example, phrenology was a “science” that claimed to measure personality and intelligence by examining the shape of the skull. Clearly, this had low reliability.

Reliability of evaluation
The reliability of evaluation is the extent to which the evaluation would give the same results if repeated in a similar situation. If you give the same test to a similar group of students and get approximately the same range of scores then the test shows reliability.