PROGRAM LEARNING OUTCOMES ANALYSIS IN HIGHER EDUCATION

AN INTRODUCTORY TUTORIAL

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The analysis of Program Learning Outcomes (PLOs) entails describing what students in an academic program should know and be able to do upon completion of the program, and then collecting and showing evidence that documents those attainments (Council of Graduate Schools, 2011; UCSC, 2013). More specifically, PLO assessment is: "The systematic process of gathering evidence of the extent to which *groups* of students—for example, those enrolled in a particular institution or programme of study, or those sharing a similar characteristic such as gender, age, or socio-economic class – perform *in the aggregate* in attaining particular levels of knowledge or skill, in order to judge the effectiveness or improve provision" (emphasis added, Kuh & Ewell, 2010).

THE PURPOSE OF THIS TUTORIAL

Beginning in the 1980s and escalating since the year 2000, the articulation of PLOs at institutions of higher education has become the norm. In the field of psychology, for instance, 88% of Associates and 94% of Baccalaureate programs surveyed in 2014 had formal PLOs (Norcross et al., 2016). Regional accreditors have influenced this upward trend because they now mandate that schools document learning outcomes and demonstrate how students meet those outcomes. Institutions of higher education must stay accredited in order to receive benefits such as student federal financial aid.

As such, assessing student learning is increasingly part of the job description for faculty at research universities, liberal arts institutions, and community colleges alike. A recent survey revealed that 78% of schools reported an upsurge in requirements for faculty to be involved in assessment over the last decade (Council of Graduate Schools, 2011). Although increasingly important, training in assessment for graduate students is not widely available.

> **A list of key resources is included in Appendix A.**

This tutorial introduces the topic of PLO assessment within institutions of higher education with the goal of preparing present and future faculty to participate in assessment efforts. Although workshops for faculty often provide new techniques and ideas for the classroom, they do not necessarily cover "the big picture" to assist educators in understanding the landscape of assessment in which they may find themselves (Liu, 2011). Thus, this tutorial will broadly describe PLO assessment as an approach to applied quantitative social science research. Because it is also important to understand the techniques and methods of PLO assessment if they are to practice these skills, this tutorial covers important considerations such as: 1) defining measurable outcomes, 2) aligning outcomes with a curriculum, 3) creating assessment plans, 4) collecting indirect and direct evidence, 5) designing new assessment tools and rubrics, 6) analyzing student learning data using a variety of techniques, and 7) reporting results for program improvement. A list of key resources for those interested in learning more is included in Appendix A.

Four Advantages for Present and Future Faculty

It is advantageous for current faculty and doctoral students to understand the processes involved in learning outcomes assessment in higher education for several reasons.

First, faculty engagement and expertise in assessment is currently one of the greatest concerns for educational institutions (Kuh & Ikenberry, 2009). The more new faculty are educated about the process of learning outcome assessment, the more they can have a voice in the definition of learning goals and the measurement of learning outcomes within their institutions. However, faculty members are just

some of the stakeholders contributing to the discussion of assessment in higher education, alongside students, government officials, parents, employers, community members, accrediting bodies, and administrators. These constituents may have many different perspectives on what constitutes a valuable educational outcome (Council of Graduate Schools, 2011). Graduate training can help future faculty gain the skills to become leaders in developing assessment systems and participating in efforts to improve their academic programs (Council of Graduate Schools, 2011).

Second, for graduate students in particular, in a tightening job market knowledge of and experience conducting learning assessment is a valuable asset to one's academic résumé.

Practicing assessment in the classroom in graduate school could enhance a teaching portfolio and help future faculty get a leg up on the competition.

Third, the assessment skillset may be useful in contexts beyond academia. Specifically, assessment skills could help graduate students find employment doing program evaluation, grant writing, curriculum design, and more.

Fourth, and finally, assessment is a growing field of applied social science research. In a recent survey, only 25% of universities had more than one full-time staff member working in assessment while 20% had no staff (Kuh & Ikenberry, 2009). As universities necessarily invest more resources in assessment, expertise in this area will be an increasingly marketable skill.

WHAT IS LEARNING ASSESSMENT? DEFINITIONS AND PURPOSE

Definition

Learning assessment entails the "systematic collection, review and use of information about student learning in order to inform decisions about how to improve teaching and learning" (Council of Graduate Schools, 2011, p. 15). Learning assessment could focus on analyzing a particular classroom activity, learning goals for a particular course, or the overall learning outcomes for an academic program. The rest of this tutorial will focus primarily on program-level assessment.

Table 1 illustrates reasons why it is important to define and assess student learning.

> **"Gauging accomplishments, understanding what is working, spotting weaknesses, using data to make better decisions "**
> **(Kuh & Ikenberry, 2009).**

PLO Assessment as Applied Research

It can be helpful to think about PLO assessment as an approach to applied social science research. The research design and analytical skills one gains in a graduate program are directly applicable to conducting research about academic programs at both the undergraduate and graduate level. As with any research, the information gathered about student learning

Table 1. Why define and assess PLOs?

Students will:	Faculty will:	The institution will:
– Know expectations,	– Articulate what students are expected to know and the skills they will acquire,	– Evaluate achievement across programs,
– Understand program as more than a set of classes,	– Communicate those expectations to students,	– Support transparency & accountability,
– Identify own strengths, weakness, progress,	– Evaluate and improve the curriculum,	– Align teaching and learning with the overall mission.
– Select a program of study.	– Measure impact of changes.	
Source: UCSC Guidelines for the development and assessment of program learning outcomes (2013).		

must of high quality if it is to have a direct impact on the effectiveness of a program, and if the results are to be easily communicated to community members, students, and other stakeholders.

Four Key Features of Assessment Research
There are several key features of applied assessment research. Most importantly, learning assessment is about analyzing students' accomplishments and competency attainment in the *aggregate*. It is never about an individual student or faculty member. In order to be actionable and focused on specific needs and opportunities for improvement, assessment should be focused at the level of a program (or sometimes a group of students such as transfer students or first-generation students within a program; Kuh & Ewell, 2010; Kuh & Ikenberry, 2009). By analyzing student learning at the program-level, faculty and administrators gain an understanding of how well an entire set of courses is meeting the goals of the department and how well the courses and instructional methods complement each other to create a cohesive program (Council of Graduate Schools, 2011).

The main goal of PLO assessment is to *improve student learning* (UCSC, 2013). Assessment research documents what students have learned, their accomplishments, and how they are developing in order to use that evidence to make decisions that will enhance the allocation of student services and improve student progress through the program (Banta, 2007; Bresciani, 2011). Thus, PLO assessment may be considered action research in the sense that the results will immediately be used to inform decisions about the allocation of resources, instructional approaches, staffing, advising, and other policies and practices aimed at program improvement (Kuh & Ewell, 2010; Kuh & Ikenberry, 2009). Assessment can also provide a structured way to document the elements of a program that are successful or educational practices that are promising and useful, in order to avoid changing or losing important features (Kuh, Kinzie, Schuh, Whitt, & Associates, 2010).

Another feature of PLO assessment is that it is *longitudinal*. That is, assessment takes place cyclically over a long period of time, often years. Longitudinal assessment is ongoing research that can illuminate the impact of long-term improvements (Council of Graduate Schools, 2011). As a cyclical process it can allow for creativity, innovation, and accountability within a program (Bresciani, 2011). Because assessment occurs over many years, it is important to integrate reflection about the process of assessment itself into the research. Specifically, assessment tools and practices should be revisited regularly along with the other possible program modifications that emerge from the assessment results.

PLO assessment is also necessarily *collaborative*. Within an academic program many people may work together to design programs, outcomes, assessment tools, criteria for learning, etc. Depending on the size and resources of a program, there may be a specific committee responsible for assessment or the entire department may be involved (Liu, 2011). Faculty will be primarily involved, but institutional research staff, departmental staff, provosts, and other administrators may also participate. In an ideal scenario, there will be collaboration across departments and disciplines in order to share knowledge about best practices. Collaboration is key in order to share the workload of assessment and make it as efficient as possible. Involving many people is important to the overall success of the assessment process itself in order to "garner collaborative ownership in the program's success" (Bresciani, 2011, p. 2). That is to say, assessment of learning is most successful when there is collaborative discussion of the evidence collected through a jointly agreed upon process and collective decisions about how to use the results to improve the program (Bresciani, 2011).

PLO Assessment for/as Teaching
Learning assessment exists at the intersection of research and teaching. Ideally, learning assessment would be so integrated into faculty practice that it could be considered a form of evidence-based teaching. PLO assessment is an opportunity for faculty to reflect on their

responsibilities as teachers and provides concrete, data-driven guidance for improving teaching practices and student learning in the classroom (Council of Graduate Schools, 2011). Through assessment research, faculty can gain an understanding of the effectiveness of their work as professional educators. Evaluating student learning and development can help faculty understand what is and is not working pedagogically, with the ultimate goal of shifting practices to enhance learning and performance. For instance, faculty could use the findings to guide pedagogical changes to improve learning within individual courses as well as to better integrate their courses into the broader curriculum or overall educational mission of the institution (Council of Graduate Schools, 2011; Kuh & Ikenberry, 2009; UCSC, 2013). When implemented within a climate that promotes experimentation and variety, learning assessment can help faculty evaluate the impact of changes to course content, teaching pedagogy, and the introduction of new learning technologies (UCSC, 2013). In this way, learning outcomes assessment is ideally integrated into the everyday practices of faculty and is informed by their experience working directly with students.

Faculty can apply the process of learning outcome assessment described below in their individual courses as well. This can be particularly useful to keep in mind for graduate students who want to demonstrate teaching excellence in their portfolios on the job market and for faculty members who are approaching tenure (Liu, 2011). In a climate of increasing emphasis on assessment, a candidate may gain an edge in hiring and promotion by illustrating a commitment to evidence-based teaching and showing how one has used assessment to inform their practices in the classroom.

THE PROCESS OF PLO ASSESSMENT

Assessing PLOs in higher education requires careful forethought and occurs through an organized, multi-year cycle (UCSC, 2013). As seen in Figure 1, this cycle involves several steps that will be repeated over time. The ongoing nature of an assessment cycle facilitates reflection about the process itself and ideally will encourage creativity, innovation, and accountability (Bresciani, 2011). As part of the ongoing cycle, both the learning outcomes and the methods used to assess those outcomes are evaluated and improved.

1. Articulate Measurable PLOs
The first step of the assessment cycle is for the academic department or program to collectively define what they expect students to learn by the time they graduate with a degree in the field (UCSC, 2013). More specifically, they will need to articulate PLOs: "a set of statements that specify the fundamental knowledge, skills, abilities, and attitudes students will develop" over the course of their studies (UCSC, 2013, p. 3). These outcomes should be defined in relation to the specific needs and aims of the program. The goals for learning should be criterion-
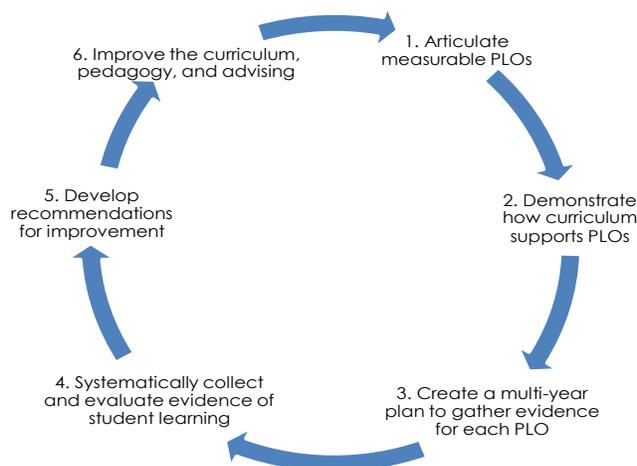

Figure 1. The Program Learning Outcome Assessment Cycle
Source: UCSC Guidelines for the development and assessment of program learning outcomes (2013).

based, which means that they are explicitly focused on concrete skills and abilities that can be improved upon. Examples include using quantitative reasoning, properly citing sources in a paper, or collaborating with peers.

Table 2. Defining Program Learning Outcomes (PLOs)

⊘ PLOs Are:	⊗ PLOs Are NOT:
– Criterion-based program goals. – Fundamental knowledge, skills, abilities, competencies, attitudes that students will develop through their program of study. – Life-long skills students will acquire by the time they graduate.	– Course grades. – Cumulative or major GPAs. – Credits earned. – Average time to degree. – Degrees or certificates granted. – Rates of graduates' employment. – Graduates' salaries.

Source: Council of Graduate Schools, 2011; Kuh & Ewell, 2010.

Importantly, learning outcomes are not broad measures or proxies of learning such as the number of students who complete a degree or how many students gain employment after graduation (see Table 2). Grade Point Averages (GPAs) and course grades are also not appropriate assessments of student learning. Course grades in particular are often related to factors such as class size, the time of year, and the individuals in the class. Course grades (and thus GPAs) are based on in-class participation, attendance, and on-time submission of assignments, in addition to students' levels of abilities. As such, GPAs do not provide information about a student's grasp of a particular skill (i.e., how to clearly communicate an argument in writing). Moreover, GPAs and course grades do not indicate how a program could change in order to improve student learning in a particular area (Kuh & Ewell, 2010; UCSC, 2013).

Note that it is likely that PLO statements will already be articulated at the universities into which current graduate students will enter a faculty position. However, it is important to understand the process of articulating PLOs because they may be up for debate in certain programs and, even if agreed upon, should be reevaluated regularly. Moreover, much of the information presented here can be applied to articulating learning outcomes for courses or individual assignments.

Meaningful, Comprehensive, and Measurable
There are several key characteristics of well-designed PLO statements. First, the set of learning goals should be *meaningful* to students, faculty, professionals in the field, and to society

in general (Bresciani, 2011). Intuitively, programs should measure the learning outcomes that it values, not simply those that are easiest to collect and quantify (Council of Graduate Schools, 2011). PLOs are most likely to be meaningful when faculty are actively involved in defining them from the "bottom-up" in collaboration with assessment experts at their universities (Council of Graduate Schools, 2011). In addition, it is important to keep in mind the skills and values students themselves want to acquire by thinking about each outcome from the students' point of view (Driscoll & Wood, 2007, as cited in UCSC, 2013).

Meaningful PLOs will vary by level of the program (i.e., undergraduate, Master's, PhD) and will be unique to a specific program's aims and mission. With some variability, PLOs will align with standards of the discipline more broadly, in order to prepare students for graduate school or employment in the field. For instance, the American Psychological Association has articulated some guidelines to facilitate the development of PLOs relevant to the discipline (APA, 2013).

Some of the PLOs for specific programs will also be related to the broader institutional mission and its general education (GE) curriculum. For example, the learning goals of a psychology program may include core competencies such as writing and critical thinking. These form the platform on which to build more specific and advanced knowledge of the field, such as the ability to use psychology theory to construct a convincing argument. Out of 1,518 schools surveyed in 2009, three-quarters had a common set of learning outcomes for all undergraduates, although large research

universities were less likely to have a shared set of PLOs (Kuh & Ikenberry, 2009).

Second, as a set, the learning outcomes for a program should be *comprehensive*. Of course, not all PLOs will be measured at once, but the list itself should specify the key disciplinary knowledge and relevant general skills (i.e., oral communication, critical thinking) that should be acquired if a student is engaged in the program as intended (Bresciani, 2011; Council of Graduate Schools, 2011). It is not realistic to have more than approximately eight PLOs for a program, but there should still be a broad range of skills articulated (UCSC, 2013).

Third, the PLOs must be articulated in such a way as to be *measurable*. Learning goals must be operationalized so that it is very clear how to know that learning has indeed occurred. Broad goals must be carefully broken down into criterion-based outcomes in order to be able [to] assess strengths and weaknesses across v[arious] types of students and across different dimensions of [...] 2010). T[...] broad educatio[...] more specific v[...]

Measurable PL[...] characteristics. specific to only[...]

are stated simply and clearly without too much detail (Bresciani, 2011). Good operationalizations will include active verbs that specify actions taken by a student that can be directly observed (Adelman, 2015). "Design," "conduct," "take physical measurements and analyze the results," "write effectively," and "articulate" are some examples of such active language (see Appendix B for a list of operational verbs). It must be clear how exactly a student will demonstrate the skill, so phrases like "understand," "know," "recall," and "develop" should be avoided. As one expert noted: "One does not know a student has the "ability" to do anything until the student actually does it, at which point we use verbs that indicate what the student actually did" (Adelman, 2015). The PLO statement should include both the cognitive or motor action and the thing on which the student will act. That is, a student needs to know *what* they are expected to produce: What [...] at will they [...] ill be about an [...] the learning [...] raduates will [...] ing outcome. [...] avoid when [...] sider, practice, [...] onsult, act, and [...]

Program goals

Program Learning Outcomes
that can be evaluated based on a student's senior research project

... demonstrate familiarity with the major concepts, theoretical perspectives, empirical findings, and historical trends in [psychology, physics, etc.].

a. use of the concepts, language, and major theories of the discipline to account for psychological phenomena.

b. apply physical principles to explain, analyze, and predict a variety of natural phenomena.

Table 3. Example of Operationalizing a Broad Learning Goal

	Program goals	Program Learning Outcomes
Students will be able to	... understand and apply basic research methods in [psychology, physics, etc.], including research design, data analysis, and interpretation.	a. design and conduct basic studies to address psychological questions using appropriate research methods. b. take physical measurements in an experimental laboratory setting and analyze these results to draw conclusions about the physical system under investigation
	... communicate effectively.	a. Write effectively following professional writing conventions [in psychology] appropriate to purpose and context. b. clearly explain their mathematical and physical reasoning, in writing [physics].

Source: UCSC Guidelines for the development and assessment of program learning outcomes (2013).

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PLO attribute #2. A **comprehensive** set of program learning outcomes will be different at the undergraduate and graduate levels and should be written at the appropriate

Table 4. Example Operationalizing a PLO from Psychology

Goal 4: Communication	Students will: 4.1 Demonstrate effective writing for different purposes	4.1A Construct arguments clearly and concisely using evidence-based psychological concepts and theories 4.1D Employ APA writing style to make precise and persuasive arguments

Source: APA Guidelines for the Undergraduate Psychology Major, Version 2.0 (APA, 2013, p. 30).

2. Demonstrate how the Curriculum Supports the PLOs

After articulating a comprehensive set of meaningful and measurable PLOs, a department or program creates a curriculum map to show where and when students will have an opportunity to develop important skills (Bresciani, 2011; UCSC, 2013). It is essential to map the specific learning experiences in which students will have a chance to practice or demonstrate the skills articulated in the set of PLOs, because "learning needs to be purposefully facilitated and not just expected" (Bresciani, 2011). Students have to be given the opportunity to develop skills, and a curriculum matrix is designed to ensure that the learning outcomes align with the design of the curriculum and other learning experiences. Alongside the courses in a program, a curriculum map may include field studies, internships, symposium, or other co-curricular experiences (UCSC, 2013). A curriculum map should be published so students can understand the overarching objectives of their program and assess their own progress attaining those outcomes through the curriculum.

The mapping process provides the faculty with a chance to reflect on the relative importance of courses and the level of proficiency a student will be expected to achieve by graduation if they are given opportunities to learn (UCSC, 2013). In addition, the process could reveal that some skills are not adequately addressed in the current curriculum. Ideally, all faculty members in a program will participate in completing the curriculum matrix by reflecting on each of their courses. Re-mapping should occur routinely over time as new courses are developed and each PLO is assessed.

A hypothetical curriculum map can be found in Table 5. Table 5 shows how a program could document when exactly a topic is introduced (indicated as "I") as well as when undergraduate students would have an opportunity to practice (indicated as "P") and demonstrate (indicated as "D") their proficiency. Note that some skills are learned across a variety of courses and some are only addressed in specific courses). Collection of evidence for specific PLOs would occur in the courses in which students were expected to be able to demonstrate their abilities.

> **"If the PLOs are an accurate and comprehensive reflection of the faculty's expectations about what students should be learning then it follows that the curriculum will support those outcomes, including introducing critical information, and giving students opportunities to practice skills, and ultimately to demonstrate mastery and achievement of the outcomes" (UCSC, 2013, p. 4).**

Table 5. Hypothetical Example of Undergraduate PLOs Aligned with the Curriculum

Courses	Program Learning Outcomes (PLOs)					
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
10 Introduction to Sociology	I	I	I	I	I	I
15 Issues and Problems		I				
30 World Society		I				
100 Statistical Methods	P		P	P		
105 Logic and Methods of Social Inquiry	P		P	P		
<Upper division course 1>		P		P		P
<Upper division course 2>		D			P	P
Internship					P	D
Capstone Course	D		D	D	D	

Source: UCSC Guidelines for the development and assessment of program learning outcomes (2013).

3. Create A Multi-Year Plan to Gather Evidence

Once a list of PLOs exists and is mapped to the curriculum, a plan of action to assess and evaluate learning must be developed. When done as a multi-year process, assessment becomes regularized as part of the department practices. The ongoing, longitudinal cycle of assessment makes it possible for departments to evaluate one or two of their outcomes each year, rather than try to do everything at once. Thus, conducting assessment over multiple years makes assessment both flexible and manageable. The number of outcomes in any give year and the order in which they are assessed can vary depending on faculty interests, availability of resources, and time needed to collect data that is credible (UCSC, 2013). Each outcome will eventually be reassessed to see if the decisions and changes to the program actually improved student learning as expected (Bresciani, 2011).

A multi-year plan will include a detailed method for assessing each PLO that is carefully aligned with the outcome. This plan will describe the year in which the study of each PLO will be conducted, which students will be assessed, which type(s) of data will be collected as evidence of learning, which assignments will be used to gather data, what criteria will be used to evaluate student work, and who will be responsible for collecting and analyzing the data for a report (see UCSC's assessment guidelines for an example multi-year plan; UCSC, 2013).

What is/are the research question/s?

As part of an assessment plan, faculty should articulate specific research questions in advance. These research questions will address gaps in knowledge about student learning and the concerns of various stakeholders (Kuh & Ikenberry, 2009). As part of developing research questions, faculty may want to conduct an "assessment audit" to see if there are methods, tools, or data already available through an institutional research office or the department, in order to understand what is already known about student learning in a specific area (Oakleaf, 2009b).

Research questions may range from simple to complex. They could address any or all of the following: who is learning, what is being learned, when is it learned, and to what extent is

it learned? For example, a department could explore students' oral communication abilities at the time of graduation or whether communication skills vary by first generation status. Faculty may be interested in whether the introduction of a new course or a different sequence of courses has a relationship to student learning. Courses of various sizes could also be examined to collect data about whether variations in student learning reflect different learning contexts.

Who will be assessed?

As part of writing a multi-year assessment plan, faculty must decide who will be the target audience for each outcome (Oakleaf, 2009b). They will describe who is the most significant, appropriate or necessary audience for each learning assessment. Often, this target audience will be graduating seniors because PLO assessment is usually concerned with evaluating the level of achievement gained by the end of a specific program of study. Yet, it may not be feasible to collect data on all graduating seniors and decisions may have to be made about taking a sample of seniors instead. Because the department knows exactly who is in their population of study, it is easy to take a random sample from within that population. A random sample could be taken from one or more courses across one or more instructors. To obtain a large enough sample for a specific course or type of course (i.e., all senior seminars) it may make sense to sample students over several academic terms. Sometimes comparison groups will be included in an assessment: for instance if the research question is about comparing transfer students with students who enrolled in the university as freshman.

What measures will be used?

In order to reduce subjectivity and ensure consistency, valid and reliable measures should be articulated as part of the multi-year plan. The same measure(s) will ideally be used from year to year, from student to student, and from assignment to assignment. Generally, there are two types of evidence that will need to be gathered as part of PLO assessment in higher education: direct evidence of student learning based on performance on exams or assignments, and indirect evidence based on student surveys or interviews (described in more detail below; UCSC, 2013).

It may be possible to adapt existing measures created by national organizations within specific disciplines or by an office of institutional research and assessment for a specific university context (see Appendix A for resources). Often, however, new measures will need to be designed. Development of new measurement tools takes time and careful fine-tuning through a collaborative process. For each measure, it is important to articulate ahead of time what level of achievement would meet departmental standards or that would show that evaluation criteria had been met (Oakleaf, 2009b; UCSC, 2013). For instance, would the program expect that 100% of students have mastered the skill of developing a research hypothesis, or perhaps just 75%? A solid assessment plan will list the items, surveys, rubrics to be used, the rationale for using each them, and anticipate their limitations (Oakleaf, 2009b).

4. Systematically Collect and Evaluate Evidence of Student Learning

After careful planning, faculty will systematically collect, analyze, and interpret evidence of students' achievement of the PLOs. Assessment teams are encouraged to utilize data triangulation by collecting several kinds of evidence about each PLO. According to a recent survey, 90% of schools used at least one measure of both direct evidence and indirect evidence (Kuh & Ikenberry, 2009).

Indirect Evidence

Collecting indirect evidence of student learning entails gathering *perceptions* of learning. These measures are essentially proxies for learning in that they are not external observations of student achievement. Indirect measures of learning may include interviews, surveys, and focus groups with current students or recent graduates. Sometimes they may entail surveys of employers or alumni (Kuh & Ewell, 2010).

Departments may need to design their own senior exit surveys, being careful that survey questions align with each PLO. Ideally, indirect assessments will take the form of student self-assessments that ask students to reflect on their skills both when they started at the university and currently at the time of the assessment (Douglas, Thomson, & Chun-Mei, 2012). Asking students to reflect back on their learning is more convenient than collecting pre- and post-test data. This makes it possible to conduct just one assessment in which students make an informed answer based on first-hand experience with the expectations and abilities required of them.

It may be possible to use indirect evidence that has already been collected by the university's office of institutional research or the department (Tweedell, 2011). Most (92%) schools in a recent survey used at least on campus-wide sample so they could make claims about the entire institution (Kuh & Ewell, 2010; Kuh & Ikenberry, 2009). For instance, at UCSC a survey of undergraduates is conducted biennially that asks them to rate many of their abilities: quantitative (mathematical and statistical) skills, analytical and critical thinking skills, ability to be clear and effective when writing, ability to read and comprehend academic material, foreign language skills, ability to speak clearly and effectively in English, ability to prepare and make a presentation, ability to appreciate the fine arts, ability to appreciate cultural and global diversity, computer skills, internet skills, and library research skill.. Faculty can sometimes request that program-specific questions be added to such surveys (UCSC, 2013).

Indirect evidence can also involve student reflection papers or self-evaluations in individual courses. These can be particularly useful for gathering feedback about student experiences with "teaching-learning practices" and student insights about what needs to be improved in a course or program (Kuh & Ewell, 2010).

Figure 2 shows an example of an assessment of indirect evidence. In this example assessment, students were given two extra credit points for completing the evaluation and were informed that the feedback would be used to improve the course.

Thinking back to the beginning of this course, please rate (or describe) your skills or abilities to…

Please describe **your current** (at the end of this course) skills or abilities to...

cite your sources in the paper using APA style (6-point scale from very poor to excellent)

Close-ended and open-ended questions about teaching activities

Please specify whether the following in-class activities and other features of this course helped you learn research and writing skills.

Figure 2. Example of Collecting Indirect Evidence

Direct Evidence

In addition to collecting indirect evidence, all PLO assessment projects will entail gathering direct evidence of student learning. Direct evidence must be based on tangible examples of student work or thinking (Council of Graduate Schools, 2011). The type of direct evidence collected should correspond with the type of learning outcome being assessed (UCSC, 2013).

Faculty should collectively decide on the most appropriate assignments that will allow students to demonstrate the most advanced level of their skills for their specific program. It may be possible to revise existing assignments, although some programs may choose to create new ones. The same or analogous assignments should be used when assessing a PLO across several courses taught by multiple instructors. One assignment may be used to assess more than one PLO.

Table 6. Examples of Direct Evidence

• Research papers (or proposals) • Senior theses or other capstone experiences • Portfolios (ePortfolios) • Recitals or performances • Presentations/speeches • Exams (or set of questions within) • Measures of specialized knowledge • Artistic works or exhibitions	• Laboratory experiment reports • Game inventions • Works cited pages • Posters • Group projects • Role-playing • Standardized tests
Sources: Banta, 2007; Council of Graduate Schools, 2011; Oakleaf, 2009; UCSC Guidelines for the development and assessment of program learning outcomes (2013).	

Table 6 shows examples of the types of assignments that can be used to gather direct evidence. Generally, students are asked to demonstrate their disciplinary training in a real-life situation or task that challenges them to integrate and apply what they have learned in the program (Kuh & Ewell, 2010; Tweedell, 2011; UCSC, 2013). In order for direct evidence to be authentic to students' learning, it is best practice to choose curriculum-embedded assignments that students are already doing in their coursework at key points in the program, rather than create additional special requirements. Capstone experiences such as senior research projects or recitals are especially valuable because they show integration and application of knowledge and can provide direct evidence of several PLOs at once (i.e., written communication, research skills, critical thinking; UCSC, 2013).

Asking a student to approach a situation or task as a person with disciplinary training provides evidence of their competencies in a more concrete and useful way than taking an exam. However, exams may be used. When exams are to be used, it is cheaper and more appropriate to develop an in-house exam, rather than pay for a large-scale standardized test (Banta, 2007; Tweedell, 2011). Standardized tests are not designed to align with

Example Assignment

Assignment Description

Opposing Position Paper
Write an evidence-based argument in support of the opposing position of your Position Paper. Similar to the Position Paper, make sure to have a clear position statement that justifies your position and concludes by recommending a specific policy that would best address the social issue. Also make sure to specifically address your position and policy proposals from your Position Paper.

Assignment Objective
To understand different approaches to and perspectives on a social issue while crafting a strong evidence-based policy position on a social issue based on research.

Assignment Learning Outcomes
After completing this assignment, students will be able to…

- (A) **formulate** and **articulate** a problem statement and logical argument from an opposing position on this social issue
- (B) **conclude** with a specific policy that addresses the social issue
- (C) **choose** 3-5 sources to support your position
  - including background, 2 peer reviewed and gray literature
- (D) **employ** and **integrate** sources to provide sufficient and effective evidence for your argument
- (E) **cite** using APA style
- (F) **write** in APA rhetorical style
- (G) **read** and **give critical feedback** to other students' papers during peer review
- (H) **respond** to critical feedback to improve your own work

Figure 3. Example of Collecting Direct Evidence

a specific program or institution's mission, and thus have limited utility in guiding changes that will improve student learning. To use multiple choice or short-answer questions to collect assessment data, faculty would need to map each question onto specific outcomes and articulate

the levels of proficiency demonstrated by each answer. For example, faculty could decide that answering four out of five questions correctly on a topic would correspond with exceeding their expectations.

Analytical Rubrics for Measuring Direct Evidence

Assessment rubrics are one of the best ways to collect direct evidence of student learning from an assignment. These rubrics are "specially designed scoring guides" that provide a way to concretely operationalize the PLO (Kuh & Ewell, 2010). Rubrics facilitate consistent scoring and allow for comparisons to be made at the aggregate level (Council of Graduate Schools, 2011). Essentially, a rubric is a textual document that describes the agreed upon values of a program, against which students' work is assessed (Oakleaf, 2009a).

> **In a recent survey of psychology programs, 57% of Baccalaureate programs used rubrics to assess most or all of their students, while locally developed exams, surveys and final project assessments were used by 40% (Norcross et al., 2016).**

PLO assessment is criterion-based, meaning that each assignment will be analyzed based on specific competencies and skills, not just as a whole. Analytical rubrics break down a PLO into essential dimensions or traits in order to observe and measure strengths and weaknesses across various criteria (Oakleaf, 2009a). The dimensions are judged separately but can also be combined. A rubric will include a task description, evaluation criteria, the levels of the task that must be met to succeed, and a scale of evaluation (Council of Graduate Schools, 2011). Figure 4 shows the basic parts of an example analytical rubric aligned with the example assignment discussed above.

Creating Rubrics

Developing analytical rubrics requires time and collaboration by faculty members because these tools need to be fine-tuned in order provide reliable and accurate data (Kuh & Ewell, 2010). If a program wants to assess a core competency

like written communication, it may be possible to utilize or modify existing rubrics that have been validated across various settings such as the VALUE rubrics from the Association of American Colleges and Universities (see Appendix A for rubrics and resources).

There are several important things to keep in mind when creating analytical rubrics (UCSC, 2013):

- Generally, rubrics have between four and five categorical answer options.
- In order to be usable, task descriptions should be simple and quick to read.
- Like any good survey question used for research purposes, if the rubric is too vague you will get useless results.
- Descriptions must make it clear what student work does and does not count in order to have met faculty expectations.
- The criteria for performance level categories (i.e., meeting expectations, almost meeting expectations) should be mutually exclusive. A student should get a score at only one level.
- The categories should be designed in such a way so that not all students will meet expectations. If everyone "exceeds expectations" on a rubric this may be an indication of a ceiling effect, making it difficult to use the rubric to provide guidance for program improvements.
- Rubrics can be used to do assessment and assign grades to an assignment at the same time.

Training and Reliability

After rubrics are created, it is important that those using them to do assessment take part in training sessions (Oakleaf, 2009a; UCSC, 2013). These "norming" or "calibration" sessions ensure that raters are using the rubrics in the same way. At such trainings, the raters discuss the rubric criteria, assess an assignment individually, and then discuss discrepancies and clarify expectations. The process is repeated as many times as necessary to reach consensus about how to apply the rubric. This is essentially a process of establishing inter-rater reliability.
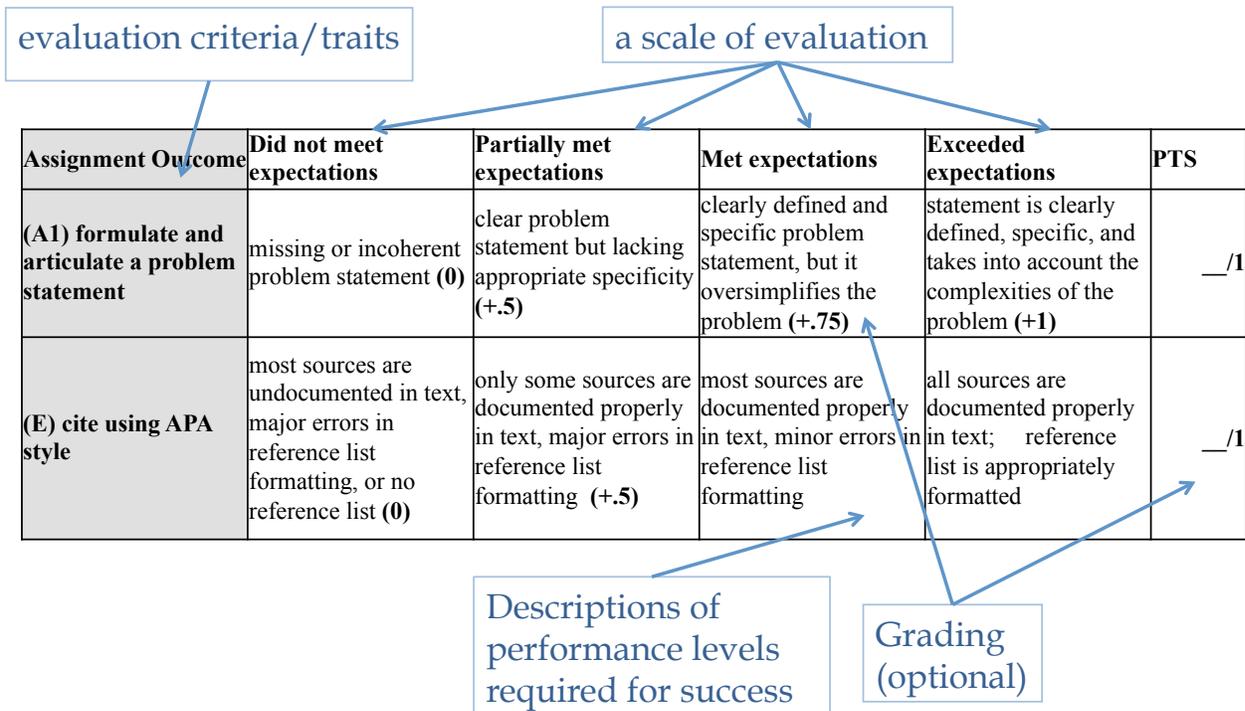
evaluation criteria/traits

a scale of evaluation

Assignment Outcome	Did not meet expectations	Partially met expectations	Met expectations	Exceeded expectations	PTS
(A1) formulate and articulate a problem statement	missing or incoherent problem statement **(0)**	clear problem statement but lacking appropriate specificity **(+.5)**	clearly defined and specific problem statement, but it oversimplifies the problem **(+.75)**	statement is clearly defined, specific, and takes into account the complexities of the problem **(+1)**	__/1
(E) cite using APA style	most sources are undocumented in text, major errors in reference list formatting, or no reference list **(0)**	only some sources are documented properly in text, major errors in reference list formatting **(+.5)**	most sources are documented properly in text, minor errors in reference list formatting	all sources are documented properly in text; reference list is appropriately formatted	__/1

Descriptions of performance levels required for success

Grading (optional)

Figure 4. An Example Analytical Rubric for Written Communication

There will likely be several faculty members using the rubrics during each PLO assessment, and it is important that each understands and uses the rubric similarly. Even if training did not occur, measures of inter-rater reliability can be used to test whether the rubric is being applied evenly (Oakleaf, 2009a). Cohen's *k* and Chronbach's alpha are two examples of reliability measures that have been used in PLO assessment projects (Bresciani et al., 2009; Oakleaf, 2009a).

Sharing and Using Rubrics
After training, faculty members who did not teach the chosen sample of students will read and assess student responses. The names of the instructors and students will be removed from the assignments to ensure blind ratings.

Rubrics should be shared with students in teaching materials and online so they know what is expected of them (Council of Graduate Schools, 2011). At the course- or assignment-level, rubrics can also help students learn to evaluate their own work or be used for peer-review. When the results are shared, rubrics facilitate directed feedback so students know what they have learned and what they have yet to learn (UCSC, 2013). They allow the instructor and students to track gains in learning (i.e., from the first to last draft of a paper or the first to last paper).

Analyzing the Data
As in any research project, once data are collected they must be carefully analyzed and discussed in a report.

Quantitative Analysis of Direct Evidence
Generally, quantitative data will be analyzed at the aggregate level using tallies, percentages, and/or ranges (Council of Graduate Schools, 2011). On an analytical rubric, each criterion is analyzed individually (see Table 7). Faculty may also compute a combined score for the entire rubric. Ultimately, faculty will analyze the proportion of students in the program who met or exceeded their expectations in regard to every PLO (UCSC, 2013). In the example shown in Table 7 we can see that 76% of students were either "met" or "exceeded" expectations for citing in APA style.

Table 7. Analyzing Evidence from Analytical Rubrics

Assignment Outcome	Did not meet expectations		Partially met expectations		Met expectations		Exceeded expectations		Met or exceed expectations (combined)		
	Count	%	Count	%	Count	%	Count	%	Count	%	Total N
(E) cite using APA style	most sources are undocumented in text, major errors in reference list formatting, or no reference list		only some sources are documented properly in text, major errors in reference list formatting		most sources are documented properly in text, minor errors in reference list formatting		all sources are documented properly in text; reference list is appropriately formatted				
	1	1%	34	23%	55	38%	56	38%	111	76%	146

Analyses of means are typically *not* used because rubrics with four or five points on the scale of evaluation reveal categorical, not continuous, data. If this were a 4-point scale taking a mean score would only tell us that students' citation skills were 3.14 on average, which is somewhere just above "met expectations." Categorical data is better because it allows program faculty to set useful goals such as setting a target percentage of students that should meet expectations. Percentages are also better for knowing the proportion of students that did not meet expectations. In the example above, knowing that less than 5% of students did *not* meet faculty expectations is more helpful than knowing the average rating of 3.14. Moreover, averages are not as useful as categorical data when drawing conclusions about whether any action needs to be taken based on the assessment data.

Quantitative Analysis of Indirect Evidence
Indirect evidence of student learning (i.e., from a student self-assessment survey) is analyzed in much the same way as direct evidence. Table 8 shows results for the example indirect evidence discussed above. Students rated their abilities at the beginning of a course and currently (at the end of the term). The proportion of students who rated their skills as "very good" or "excellent" was of most interest to faculty in the example program, because, as seniors, students should be mastering the ability to cite sources correctly.

In addition, by subtracting each student's ratings at the beginning of the course from their current ratings, an indirect measure of gains in skills can also be obtained. In this example, 82% of students' citation abilities showed improvement.

Connecting Direct and Indirect Evidence
When both direct and indirect evidence of student learning is collected for a PLO study, it is useful to explore the correspondence between sources of information. This provides a means of data triangulation. For instance, if 71% of

Table 8. Analysis of Indirect Evidence

Please rate (or describe) your skills or abilities to…	Very poor	Poor	Fair	Good	Very good	Excellent	Very good or Excellent	Total N
Cite your sources in the paper using APA style **at the beginning of the course**	19%	27%	22%	17%	8%	8%	15%	132
… currently	0%	0%	6%	23%	50%	21%	71%	131

students rated their ability to use proper citations as "very good" or "excellent" (indirect evidence), it would be consistent with 76% of students meeting faculty expectations (direct evidence). Knowing this provides both support for the rubric as a measurement instrument and additional confirmation of student learning at the program level.

Group Difference Tests
Commonly, PLO research questions are directed at understanding inequities in student learning or assessing shifts in student learning over time. Program faculty may analyze student performance by gender, transfer status, first generation status, English language ability, or ethnicity. Or, they may assess student performance across different sections of a course or across years of course implementation. Disparities can be identified by conducting Chi-Square analyses to see if all groups are meeting expectations at similar rates. Significant group differences should inform necessary actions and improvements at the program level.

Chi-Square analyses are conducted to assess group differences, a four-point rubric would be collapsed into two categories: those who *met/exceeded* expectations versus those who *did not meet/almost met* expectations. Then, faculty could explore whether the proportion of students that met/exceeded faculty expectations in one comparison group is significantly different from the proportion in another group.

Of note, depending on the comparison groups, there may not be an adequate sample to do a full analysis of equity. By planning ahead and articulating research questions in advance, it may be possible to do a stratified random sample to purposefully gather student responses from specific interests groups or to collect data over multiple years.

With an adequate sample and access to institutional data, more complex analyses can be conducted to explore possible explanations for inequities in student learning. Campus institutional research offices store student data such as demographic information, test-scores, language proficiencies, GPAs, and more. If a

student identification number is collected along with direct or indirect evidence of student learning, it can be connected with such data. Combining such data allows faculty to perform multivariate analyses to better understand student learning. For example, they could explore whether student performance on a written communication PLO differed by ethnicity and whether that difference might be explained by overall GPA, English as a second language status, or use of tutoring services. Institutional data can also reveal whether the characteristics of the sample utilized for a PLO assessment study correspond with the demographic make-up of the department more generally. Understanding how representative the sample is of the population of students in the program can help faculty understand student learning and possible program improvements in context.

Analysis of equity in the attainment of PLOs is particularly important in a context of rapid growth and change at institutions of higher education. Universities and colleges must respond to an influx of first generation students, increased enrollment, and shifts to online and mixed courses. Incorporating group difference tests into learning outcomes analysis can help academic institutions and individual programs ensure they are addressing issues of access and providing quality education to all students.

Qualitative Summaries
Both indirect and direct evidence may take the form of qualitative data. Qualitative data provide detailed information about student learning, and can be aggregated into qualitative summaries (Council of Graduate Schools, 2011). Most often qualitative data are solicited as part of student self-reflection papers, interviews, or focus groups and thus are forms of indirect evidence. Such evaluations can be particularly useful for helping faculty understand learning from the students' perspective and to obtain ideas for course and program improvements. Analyzing qualitative data can be time consuming, but methods have been developed to automate some of the process using NVivo software (for more information see Blaney, Filer, & Lyon, 2014).

5. Develop Recommendations for Improvement

Perhaps the most important step of the PLO assessment process is to discuss and report the analyzed results in relationship to recommendations for program improvement (Kuh & Ewell, 2010; Tweedell, 2011). Results will ideally be examined and discussed collaboratively by all faculty members in an academic program so everyone has a role in generating ideas for improving student outcomes (Bresciani, 2011). Reports will likely cover conclusions about program strengths, weaknesses, and observed trends in student learning over time. The style and content of written reports will likely vary based on the audience, but should generally be designed to clearly make the case for the proposed recommendations improvements.

Reports on a department's PLO assessment process and results will often be included in their self-study for program review (UCSC, 2013). At most universities, reports are also required to be submitted to the institution to be combined into reports for regional accreditors. Reports may also be distributed to the public via the department or institution's website. Depending on the audience, PLO data may be presented with visual representations like graphs and tables.

6. Improve the Curriculum, Pedagogy, and Advising

Immediate action aimed at program improvement is the overall goal of making recommendations based on the data gathered during PLO assessment. Recommendations for improvement will reflect the original research questions of the PLO assessment. In addition, the process of carrying out improvements will depend on the resources and goals of the program and institution. As such, this tutorial only covers a few general points about the types of improvements that could be made.

PLO assessments may result in changes to:
- Curriculum requirements,
- The sequences of courses in a curriculum,
- Instructional approaches and methods,
- Advising and academic support,
- Resource allocation,
- Staffing,
- Assessment practices and tools,
- Learning goals and desired outcomes.

PLO assessment may result in the adoption of:
- New teaching techniques and tools,
- Tutoring or other focused help,
- New interventions to address disparities across groups of student,
- New learning goals,
- Best practices from other programs or academic divisions within the institution or from other institutions,
- New plans for future assessments.

Recommendations should be grounded in the data, which will indicate where changes should be made in teaching, curriculum design, allocation of resources, and the assessment processes themselves (Council of Graduate Schools, 2011; Kuh & Ewell, 2010; Tweedell, 2011; UCSC, 2013). Sometimes, however, the conclusion will be to try to maintain high standards. Even if no immediate action is taken, it is still important to record and report the decisions made by the department and to articulate a plan for reevaluation of each PLO (Oakleaf, 2009b).

SOME TAKE-HOME POINTS

PLO assessment at institutions of higher education is an *ongoing, collaborative, evidence-based,* and *policy-oriented* practice. The primary aim of PLO assessment is to use data to improve student learning. In a continuous creative process, the results of one assessment cycle will inform improvements to educational techniques, curriculum design, and allocation of resources. Such changes will then be subject to exploration in the next assessment cycle. In this way, educational practices and learning outcomes are mutually reinforcing.

It is important to note that agreement about the utility and importance of PLO assessment is not universal. Some educators see the push to conduct PLO assessment as a "mandate from on high," with policy-makers and government officials from outside of the academy imposing their values. Others believe that the knowledge and skills taught by their disciplinary defy objective measurement and feel their academic freedom and autonomy are compromised by assessment. Some argue that academic programs provide too few incentives to be involved in assessment and feel greater pressure to perform in other areas such as research (Liu, 2011). Still others see such efforts as redundant or a burden because they are already overloaded and do not have enough time and resources.

However, when PLO assessment is *faculty-driven* and *relevant* to educators, they are more likely to be motivated to reflect on their practice as teachers and engage in assessment of those practices. Becoming involved in assessment is the only way to contribute to the definition of learning goals for students, to debates about measurement, and to the discussion of workload and department priorities. In fact, most external stakeholders, such as accreditation bodies, explicitly request and encourage full engagement by faculty. They acknowledge that faculty members are experts in their fields and are best positioned to decide what students should be learning. Faculty will be the ones to implement program improvements that support that learning, so their engagement in assessment is essential.

This tutorial was designed with the intention of increasing graduate students' awareness of learning assessment so they can become key players. The research skills that graduate students acquire in their Master's or Doctoral programs are directly applicable to the assessment context. As new faculty they will be able to apply their knowledge about articulating research questions, designing measures, best-practices in sampling, collecting appropriate data, quantitative and qualitative analytical techniques, and concise written communication of results. Knowledge about learning assessment processes within the context of higher education will make the transition to a faculty position much smoother. As efforts to assess student learning increase nationally and internationally, there will be more and more opportunities for those with skills in assessment to apply their knowledge as faculty experts or as staff in institutional research and assessment offices.

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Resources to Get You Started

At UCSC

Institutional Research, Assessment & Policy Studies
    Dr. Anna Sher, Assistant Director of Assessment (asher@ucsc.edu)

    Guidelines for the Development and Assessment of Program Learning Outcomes
    Assessment at UC Santa Cruz. http://planning.ucsc.edu/irps/assessment/

On the web

Assessment Commons. Internet Resources for Higher Education Outcomes Assessment.
    http://www.assessmentcommons.org/

Association for the Assessment of Learning in Higher Education.
    http://www.aalhe.org/

National Institute for Learning Outcomes Assessment.
    http://learningoutcomesassessment.org/publications.html

Books

Bresciani, M. J., Zelna, C. L., & Anderson, J. A. (2004). *Assessing student learning and development: A handbook for practitioners.* Washington, D.C.: National Association of Student Personnel Administrators.

Driscoll, A., & Wood, S. (2007). *Developing outcomes-based assessment for learner-centered education. A faculty introduction.* Sterling, VA: Stylus Publishing, LLC.

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Walvoord, B.E. (2010). *Assessment clear and simple: A practical guide for institutions, departments, and general education* (2nd ed.). *San* Francisco: Jossey-Bass.

Example Rubrics

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VALUE Rubrics. Association of American Colleges & Universities.
    https://www.aacu.org/value-rubrics

OPERATIONAL VERBS
For Writing Learning Outcomes Statements

From Adelman, C. (2015, February). *To Imagine a Verb: The Language and Syntax of Learning Outcomes Statements*. (Occasional Paper No. 24). Urbana, IL: University of Illinois and Indiana University, National Institute for Learning Outcomes Assessment.

A) Verbs describing student acquisition and preparation of tools, materials, and texts of various types (including digital and archival):
access, acquire, collect, accumulate, extract, gather, locate, obtain, retrieve

B) Verbs indicating what students do to certify information, materials, texts, etc.
cite, document, record, reference, source (v)

C) Verbs indicating the modes of student characterization of the objects of knowledge or materials of production, performance, exhibit
categorize, classify, define, describe, determine, frame, identify, prioritize, specify

D) Verbs describing what students do in processing data and allied information
calculate, determine, estimate, manipulate, measure, solve, test

D1) Verbs further describing the ways in which students format data, information, materials
arrange, assemble, collate, organize, sort

E) Verbs describing what students do in explaining a position, creation, set of observations, or a text
articulate, clarify, explicate, illustrate, interpret, outline, translate, elaborate, elucidate

F) Verbs falling under the cognitive activities we group under "analyze"
compare, contrast, differentiate, distinguish, formulate, map, match, equate

G) Verbs describing what students do when they "inquire"
examine, experiment, explore, hypothesize, investigate, research, test

H) Verbs describing what students do when they combine ideas, materials, observations
assimilate, consolidate, merge, connect, integrate, link, synthesize, summarize

I) Verbs that describe what students do in various forms of "making"
build, compose, construct, craft, create, design, develop, generate, model, shape, simulate

J) Verbs that describe the various ways in which students utilize the materials of learning
apply, carry out, conduct, demonstrate, employ, implement, perform, produce, use

K) Verbs that describe various executive functions students perform
  operate, administer, control, coordinate, engage, lead, maintain, manage, navigate, optimize, plan

L) Verbs that describe forms of deliberative activity in which students engage
  argue, challenge, debate, defend, justify, resolve, dispute, advocate, persuade

M) Verbs that indicate how students valuate objects, experiences, texts, productions, etc.
  audit, appraise, assess, evaluate, judge, rank

N) Verbs that reference the types of communication in which we ask students to engage:
  report, edit, encode/decode, pantomime (v), map, display, draw/ diagram

O) Verbs, related to modes of communication, that indicate what students do in groups:
  collaborate, contribute, negotiate, feed back

P) Verbs that describe what students do in rethinking or reconstructing
  accommodate, adapt, adjust, improve, modify, refine, reflect, review