

Program Learning Outcomes - Notes and Guidance

Program Learning Outcomes (PLOs) capture the enduring learning students should obtain over an entire program. In writing these, start with the question, “What do we want students to be able to do at the end of a program?”

Terminology and Requirements

1. **Learning Outcomes** must require higher-level thinking skills (see below) and be observable and measurable.
2. **Concepts** are the necessary topics that students must learn to complete the outcome. Create a list of nouns and noun phrases identifying the topics.
3. **Competencies** are the necessary skills students must learn to complete the outcome. Create a series of sentences focusing on the verbs and verb phrases describing the skills.
4. The **Assessment Method** is where students demonstrate the learning outcome. Be sure to include and identify both direct and indirect methods.
 - a. Direct Assessments measure student knowledge by assessing their performance on activities such as projects, exams, and other assignments. These should be specific and unique to each learning outcome.
 - b. Indirect Assessments measure students’ perception of their own knowledge. This is done almost universally through student exit surveys for the program.
5. A **Measure** is how data will be extracted from both assessment methods.

Sample Outcome

BS in Artificial Intelligence (CS)

Learning Outcome: Students will design and analyze algorithms and reason about their correctness and performance.
Concepts: Runtime and storage complexity, big-O notation, program correctness
Competencies: compare algorithm types for a problem, estimate algorithm complexity, implement and compare sorting and searching algorithms, specify and choose optimal data structures for a given problem
Assessment Methods: programming assignments, analyze pseudo-code, analyze multiple algorithmic solutions to the same problem (direct), and student exit survey (indirect)
Measures: correctness against test cases, instructor grading of homework assignments and exams (direct), faculty and administrator review of responses to student exit survey

Required Number of PLOs

Majors (undergraduate, graduate)	Minimum 3 (3-5 recommended)
Minors (undergraduate, graduate)	Minimum 2 (2-3 recommended)
Certificates (undergraduate, graduate)	Minimum 1 (1-3 recommended)

Substantial change forms do not require new PLOs, but when included, they must follow the above requirements for the type of program being changed.

Higher Level Thinking Skills

Learning Outcomes and Competencies need to reflect higher-level thinking: consider using verbs from the Application, Analysis, Synthesis, and Evaluation columns from the list below when writing learning outcomes. Source:

<https://arizona.app.box.com/s/orx6coex8607hlmenrgl7dznhzjicpit>.

Application	Analysis	Synthesis	Evaluation
apply	analyze	arrange	appraise
change	appraise	assemble	assess
compute	break down	categorize	choose
construct	calculate	collect	compare
demonstrate	categorize	combine	conclude
discover	compare	compile	contrast
dramatize	criticize	compose	criticize
employ	debate	construct	decide
illustrate	determine	create	discriminate
interpret	diagram	design	estimate
investigate	differentiate	devise	evaluate
manipulate	discriminate	explain	explain
modify	distinguish	formulate	grade
operate	examine	generate	judge

organize	experiment	manage	justify
practice	identify	modify	interpret
predict	illustrate	organize	measure
prepare	infer	perform	rate
produce	inspect	plan	relate
schedule	inventory	prepare	revise
shop	outline	produce	score
sketch	question	propose	select
solve	relate	rearrange	summarize
translate	select	reconstruct	support
use	solve	relate	value
	test	reorganize	
		revise	