Program Learning Outcomes (PLOs)

Guidelines and Examples

(PLOs) are clear, measurable statements that describe what graduates of an academic program are expected to know, be able to do, and value by the time they complete the program.

They reflect the collective knowledge, skills, and professional competencies that students develop across all courses and learning experiences within the program, and they align with the program's mission, institutional goals, and labor-market or professional requirements.

In short, PLOs articulate the intended educational achievements of a program as a whole, not of individual courses.

Why it is important to write PLOs:

Writing well-defined PLOs is essential in higher education for several academic, pedagogical, and quality-assurance reasons:

1. Clarity and Transparency

PLOs clearly communicate to students, faculty, employers, and external stakeholders what the program aims to achieve. They make expectations explicit and help students understand the purpose and value of their learning journey.

2. Curriculum Alignment and Coherence

PLOs provide a framework for aligning:

- Courses and course learning outcomes
- Teaching and learning strategies
- Assessment methods

This ensures that all courses contribute meaningfully to achieving the program's overall goals.

3. Quality Assurance and Accreditation

Most national and international accreditation bodies require clearly articulated PLOs. They serve as a benchmark for evaluating program effectiveness and demonstrating accountability, continuous improvement, and compliance with quality standards.

4. Effective Assessment and Continuous Improvement

PLOs enable programs to:

- Assess whether students are achieving the intended outcomes
- Identify strengths and gaps in student learning
- Use evidence to improve curriculum design, teaching methods, and assessment practices

5. Relevance to Labor Market and Society

Well-designed PLOs help ensure that graduates possess relevant, transferable, and professional competencies needed by employers and society, thereby enhancing

graduate employability and social impact.

6. Shared Understanding Among Faculty

PLOs promote a common vision among faculty members regarding what the program values most, supporting coordinated teaching efforts and consistent academic standards.

Principles when writing PLOs:

- Use **action verbs** (from Bloom's Taxonomy) to make outcomes observable/measurable. Verbs like *apply, analyze, design, evaluate, create* are preferred. Avoid vague verbs like *understand, know,* etc. Teaching UNSW+3University of Wisconsin Assessment+3University of Adelaide+3

- Be student-centered: phrase outcomes in terms what *students will be able to do* by the end of the program. Academic Programs and Planning+2Office of Teaching and Learning+2

- Include the **disciplinary/field context**: specify where or how the knowledge or skill is applied or what domain. This helps ensure relevance. University of Adelaide+2Academic Programs and Planning+2

- Make them **measurable and specific**: define the criteria or standards, or give qualifiers (e.g. "using appropriate software," "under supervision," "with ethical considerations") so you know when the outcome is met. Academic Programs and Planning+2University of Adelaide+2

- Balance among different learning domains (knowledge / skills / values / attitudes) so graduates are well-rounded. University of Hawai‘i – West O‘ahu+2University of A

Program Learning Outcomes (PLOs) – Applied Mathematics

PLO	Bloom's Taxonomy Level(s)	Explanation
PLO 1: Demonstrate understanding of core mathematical concepts (calculus, algebra, probability, statistics, differential equations).	**Understand, Remember**	Students recall and explain fundamental concepts and theories.
PLO 2: Apply mathematical techniques and computational tools to solve real-world problems.	**Apply**	Students use formulas, algorithms, and software to solve practical problems.
PLO 3: Analyze and interpret quantitative data, identifying patterns, trends, and relationships.	**Analyze**	Students break down complex problems and make sense of data.
PLO 4: Evaluate mathematical models, comparing their assumptions, strengths, and limitations in applied contexts.	**Evaluate**	Students judge the appropriateness of models for different scenarios.
PLO 5: Design and develop new mathematical models or algorithms to address complex scientific, industrial, or technological	**Create**	Students generate original approaches and solutions.

challenges.		
PLO 6: Communicate mathematical reasoning and solutions effectively through oral, written, and digital formats.	**Apply, Evaluate**	Students present findings clearly to technical and non-technical audiences.
PLO 7: Demonstrate ethical responsibility and teamwork in collaborative applied mathematics projects.	**Affective Domain (Valuing/Organizing)**	Students internalize professional values while working with others.
PLO 8: Engage in continuous learning by integrating new mathematical tools, programming languages, and emerging technologies.	**Metacognitive / Create**	Students self-direct their professional growth.

Example Alignment with Bloom's Cognitive Levels

- **Lower-order thinking (Remember / Understand):** PLO1
- **Middle-order (Apply / Analyze):** PLO2, PLO3, PLO6
- **Higher-order (Evaluate / Create):** PLO4, PLO5, PLO8
- **Affective domain:** PLO7 (values, ethics, teamwork)

Note: The recommended number of PLOs is between 8-12