SLO assessment

Learning outcomes assessed:

1. Physics reasoning
2. Epistemic Beliefs
   a. Structure of scientific knowledge
   b. Nature of knowing and learning
   c. Real-life applicability
   d. Source of ability to learn

Learning outcomes measured on a scale:

Exemplary Level: 4
Above Expectations Level: 3
Satisfactory Level: 2
Below expectations: 1
Not Demonstrated: 0

Physics Reasoning:

Evidence for Physics Reasoning: Evidence can be found in the final student activities, experiments, projects, audio taped discussions, tests, and reflections.

Rubric:

Reasoning for things that happen in the sub events and/or the event using physics concepts (Newton’s laws and energy principles.)

Exemplary Level (4): physics reasoning for a phenomena at normative level (the reasoning includes a clear explanation for cause and effect. Explain relation between the patterns observed in the phenomena and physics concepts, etc.)
Above Expectations Level (3): Reasoning has most of the concepts and tied those to the most of the patterns in the phenomena. OR missing couple of patterns, concepts, or relating the patterns to the concepts. (missing 1/4th)
Satisfactory Level 2): Missing half of the normative level.
Below expectations (1): Missing most 3/4th
Not Demonstrated (0): Missing all.
**Portfolio:**

The work students do from the first week of Physics I till last week of Physics II is filled in a binder. It contains Master concept map, Topic concept maps, Grand reflections, Weekly reflections, Two projects (Phy I and Phy II), Tests, Observations, initial and final physics reasoning to the observations. Observations and physics reasoning for the experiments, Home work, Take Homes and any other student work the student does to demonstrate the learning. The work is filed as Initial Student Activities (ISA) and Final Student Activities (FSA). The portfolio shows many qualities including student prior knowledge, skills and beliefs, various stages of improvement in the knowledge, skills and beliefs.

**Audio Taped Discussions:**

At the end of each semester, students are encouraged to participate in student-teacher discussion sessions. These are audio taped. Student explains physics reasoning to his/her projects and/or to events the instructor suggests. In addition, the instructor probes student over all knowledge, connectivity, beliefs, etc.

**Instructional Process:**

The instructional process will provide each student plenty of opportunities to build his/her own holistic physics knowledge for easy recall and will help you realize proper learning process. There is no separation between the lab and lecture classes. Experiments consist of working on software simulations and PASCO based experiments. Every topic starts with student working in a team of two or three members on simulations/experiments to elicit his/her initial understanding of the concepts, relations between the involved physical quantities, and beliefs. In this activity the student will write observations and initial physics reasoning (initial explanations) in the prescribed format. This activity lasts for about one hour. The concepts and the principles are developed through daily life problems (mostly the one similar to or same as the simulation.) This is a highly interactive process with various types of questions. At this stage the student will make an effort to connect the concepts to his/her initial understanding and correct the understanding. At this stage, the student will be ready to write the correct reasoning (final explanations) for the previously made observations. This is a part of the final student activity. The final student activities include working on the experiments, correcting the physics reasoning for the initial activity, writing the reflection on the concepts and principles, and doing home work/take home problems. When working on the experiment in the lab, the student needs to write physics reasoning for the things that are happening in the experiment (observations and physics reasoning), collect the data, analyze the data and find the relations between the physical quantities with his/her own comments. Often, the student will design experiments to answer certain questions. As a part of the weekly homework activities, the student will write his/her reflections on the concepts learned that week and solve some problems.

**Epistemic Beliefs:**

Evidence for Epistemic Beliefs: Evidence can be found in surveys, the student activities, projects, audio taped discussions, and reflections.
**Structure of scientific knowledge (Axis 1)**

Exemplary level (4): Physics knowledge is a coherent, conceptual, highly-structured, and unified whole.

Above Expectations Level: 3
Satisfactory Level: 2
Below expectations: 1
Not Demonstrated: 0

Evidence in Audio tapes

- Student Statement
- Gives at least one example to support the statement
- Explains the connections for the chosen example
- Incidences experienced in these two semesters
- Evidences where the student constructed his knowledge structure based on the learning activities.

Evidence in Portfolio:

- Concept maps
- Home work
- Take homes
- Exams
- Reflections

**Nature of knowing and learning (Axis 2):**

Exemplary level (4): Learning physics consist mainly constructing one's own understanding by working through the material actively, by relating new material to prior experiences, intuitions, and knowledge, and by reflecting upon and monitoring one's understanding.

Above Expectations Level: 3
Satisfactory Level: 2
Below expectations: 1
Not Demonstrated: 0

Evidence in Audio tapes:

- Student Statement
- Gives at least one example to support the statement
• Explains the connections for the chosen example
• Incidences experienced in these two semesters
• Evidences where the student constructed his knowledge structure based on the learning activities.

Evidence in Portfolio:

• Concept maps
• Home work
• Take homes
• Exams
• Reflections

Real-life applicability (Axis 3):

Exemplary level (4): Physics apply more generally to real life. Physics is mathematical modeling of real life experiences.

Above Expectations Level: 3
Satisfactory Level: 2
Below expectations: 1
Not Demonstrated: 0

Evidence in Audio tapes:

• Student Statement
• Gives at least one example to support the statement
• Project discussion
• Discussion contains application to a real life example.

Evidence in Portfolio:

• Home work
• Take homes
• Exams
• Reflections
• Project

Source of ability to learn (Axis 5):

Exemplary level (4): Being good at physics not a matter of fixed natural ability. Most people can become better at learning physics if they work hard and use good learning strategies.

Above Expectations Level: 3
Satisfactory Level: 2
Below expectations:1
Not Demonstrated:0

Evidence in Audio tapes:

- Student Statement
- Gives at least one example to support the statement

Evidence in Portfolio:

- Reflections

Physics I and Physics II

Number of students in each category

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At the conclusion of this course you should have:

1. Learned to give physics reasoning to daily and architectural problems; recognize and apply physics concepts and principles to those problems.
2. Beliefs about the structure of physics knowledge
3. Beliefs about the nature of physics knowledge
4. Beliefs about the applicability of physics knowledge
5. Confidence on the ability to learn physics