Virtual Laboratory Experiment Design Guidelines (VLEDG)
Set II - Formulating Learning objectives

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What are learning objectives?

They are brief, clear, specific statements of what learners will be able to perform at the conclusion of instructional activities.

They should provide a clear picture of the outcome or performance you expect as a result of the experiment.

The objective needs to state what the learner is to perform, not how the learner learns.

Purpose of learning objectives

- Facilitate overall the course, session and activity development by encouraging goal-directed planning.
- Inform students of the standards and expectations.
- Provide a framework for evaluating student progress.
- Make implicit the educational contract between teacher and students.

The purpose of an objective is to give different people the same understanding of the desired instructional outcome.

How to formulate a learning objective?

1. Start the learning objective with the phrase "Student will be able to"

2. Make a decision regarding the cognitive level you wish to achieve through the experiment as per the Revised Bloom's taxonomy

3. The cognitive level of Remember is not normally chosen for a laboratory experiment. Try to formulate learning objectives at higher cognitive levels, as the virtual laboratory is more suitable for these objectives.

How to formulate a learning objective?

4. Choose action verbs appropriate to the chosen cognitive level by referring to the Tables LOa, LOb and LOc.

5. Check whether the learning objective is aligned to the broad goal of the experiment by referring to the Tables LOa, LOb, and LOc.

Table LOa - Cognitive level and action verbs - Broad Goal - Develop students Knowledge

Level	Action Verbs
Create	design, combine, devise, modify, plan, Modify the design
Evaluate	assess, conclude, contrast, evaluate, Reason out for the choice
Analyse	analyze, infer,examine, dissect, ascertain, Test a prediction
Apply	Apply, calculate, solve, predict, Explore relation between
Understand	Describe, Explain, Give example of, Select, Reason out for selection, Reason out for the observation

Table LOb - Broad Goal – Develop Skills

Skill	Actions
Manipulative skills	Observations, Measurements, Manipulations, Recording results, Calculations, Explaining experimental techniques, Explaining about various decisions and Working according to the design
Investigative skills	Transforms results into standard form (tables), Determine relationships (could include graphs), Discuss accuracy of data, Formulate generalizations, Discuss limitations/assumptions of experiment, Explain relationships and Formulate new questions/problems
Inquiry Process Skills	Formulate question or problem to be investigated, Formulate hypothesis, Determining replications, Identifying treatments, Defining dependent variable, Defining independent variable, Design experiment, Design observation and measurement procedures, Predict results, Predict applications based on results, Formulate follow up hypotheses and Apply experimental technique to new problem
Communicating results	Describing the results in a suitable format, presenting the results to peers and instructors.

Table LOc - Broad Goal – Cognitive Abilities

Cognitive Ability	Actions
Well Structured Problem Solving	Come up with solutions to well structured problems through experimentation
Ill structured problem solving	Come up with solutions to ill structured or open ended problems through experimentation

How to formulate a learning objective?

6. Check whether the learning objective can be achieved in the BAE virtual lab by referring to the Tables LOd.

7. There can be multiple learning objectives for one broad goal

LOd – Learning objectives achievable using virtual laboratories

Broad goal		
		Highest Level of Learning objectives achievable in Vlab
Knowledge	Concept	Analyze
	Procedure	Create
	Principle	Evaluate
Skill		Practical
		Manipulative
		Investigative
		Inquiry process
Cognitive ability		Problem Solving
Attitude		Team Work

What next?

In the next video we will cover the details of how you can select the Instructional Strategy for your virtual laboratory experiment.