Virtual Laboratory Experiment Design Guidelines (VLEDG) Set III - Experiment design at different difficulty levels with Expository Instructional Strategy

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Four important phases in the experiment design process for Expository Instructional Strategy

- Conception, planning and design of experiment
- Execution of experiment
- Analysis and interpretation
- Applications

Phase I - Conception, planning and design of experiment

- Formulate question or problem to be investigated.
- Decide the broad goal of the experiment
- Formulate learning objectives
- Determine replications
- Identify treatments/ Suggesting technical procedures
- Technical preparation of the experiment (assembling tools, preparing solutions, constructing circuits etc.)
- Define dependent variable
- Define independent variable
- Design experiment
- Design observation and measurement procedures
- Predict results

Modifications to increase difficulty level in Phase I

Phase of the experiment	Difficulty levels	Guidelines on how to implement the difficulty levels
Definition of the problem and Hypotheses	A1 – Low level	Define a problem which requires very little formal knowledge
	A2 – Medium level	Define a problem which requires formal knowledge
	A3 – High level	Define a problem which requires specific formal knowledge

Modifications to increase difficulty level in Phase I

Phase of the experiment	Difficulty levels	Guidelines on how to implement the difficulty levels
Technical suggestions	B1 – Very low level	Specify the equipment and materials required
	B2 – Low level	Specify the equipment and materials required but make the students carry out the assembling and ask them to give justification for the particular choice
	B3 – Medium level	Make the students prepare the tentative list of equipment or materials they would need for the experiment
	B4 - High level	Make the students prepare the tentative list of equipment or materials they would need for the experiment and also ask them to give justification for the particular choice

Phase II - Execution of experiment

- Specify Observations to be taken or data to be gathered
- Specify the Measurements to be carried out
- Describe the Manipulations possible
- Specify the various Calculations to be carried out

Modifications to increase difficulty level in Phase II

Phase of the experiment	Difficulty levels	Guidelines on how to implement the difficulty levels
Actual performance	D1 – Low level	Instructor performs the experiment and students take down the data points
	D2 – Medium level	Students perform the experiment and collect the data as per the instructors guidelines
	D3 – High level	Students make decisions regarding the performance of the experiment and collection of the data

Modifications to increase difficulty level in Phase II

Phase of the experiment	Difficulty levels	Guidelines on how to implement the difficulty levels
Actual performance	D1 – Low level	Instructor performs the experiment and students take down the data points
	D2 – Medium level	Students perform the experiment and collect the data as per the instructors guidelines
	D3 – High level	Students make decisions regarding the performance of the experiment and collection of the data

Phase III - Analysis and interpretation

- Transform results into standard form (tables).
- Determine relationships (could include graphs)
- Discuss accuracy of data.
- Report about procedures and results
- Interpretation of results

Modifications to increase difficulty level in Phase III

Phase of the experiment	Difficulty levels	Guidelines on how to implement the difficulty levels
Results and analysis of results	E1 – Low level	Instructors specify the expected results and type of analysis to be carried out and students carry out the analysis
	E2 – Medium level	Students make the decisions regarding the expected results but type of analysis to be carried out is specified by the instructors
	E3 – High level	Students make the decisions regarding the expected results and type of analysis to be carried out

Phase IV - Applications

- Predict applications based on results
- Formulate follow up hypotheses
- Apply experimental technique to new problem
- Summing up of acquired knowledge

Modifications to increase difficulty level in Phase IV

Activities	Example from course Basic Electronics
Predict applications based on results	What are the various applications where PN junction diode can be used?
Formulate follow up hypotheses	Justify with the help of an experiment that the PN junction diode is suitable for the purpose of rectification.
Apply experimental technique to new problem	Design the experiment for the above purpose.
Summing up of acquired knowledge	Write a summary of your learnings from the two experiments.

What next?

Incorporate active learning methods in the experiment with Expository Instructional Strategy.