Scientific Design of Virtual laboratory experiment

Anita S.Diwakar

Outline

- Problems with experiment designs used in traditional laboratories
- Scientific Design of laboratory experiments
- Steps in the Scientific Design of laboratory experiments
- Virtual laboratory experiment design

Problems with experiment designs used in traditional laboratories

- The engineering instructors have been using experiment designs to achieve their laboratory learning objectives in the physical laboratories for many decades.
- The review of literature indicates the shortcomings of the current laboratory experiment designs used in physical environment.

Problems with experiment designs used in traditional laboratories

- Broad Goal of the experiment:
  - In 90% of the experiment designs the Broad goal is stated as " To study ….a particular topic"
- Instructional strategy
  - 83 % of the experiment designs have used Expository Instructional Strategy, which has its limitations
- Learning Objectives
  - 76% experiments have learning objectives at lower cognitive levels

Problems with experiment designs used in traditional laboratories

- Laboratory task designs
  - In 95% of the experiment designs the tasks the students are required to perform in the laboratory are in the objects domain and 5% in the ideas domain.
- Laboratory Assessment
  - In 90% of the experiment designs the assessment questions asked were based on theory taught in the classroom.
  - The students' knowledge, skills or cognitive abilities were not assessed.

Problems with experiment designs used in traditional laboratories

- Learning Objectives of the experiment:
  - For 89% of the experiment designs the learning objective was reinforcement of theoretical concepts.
- Difficulty level of the experiments
  - 90 % of the experiment designs were at the low difficulty level
- Incorporation of active learning methods and constructivist approach
  - Experiment designs do not incorporate these

Solution to the Problems

- All these problems can be resolved by using the Scientific Design of laboratory experiments.
- The Scientific design will help in improving the quality of experiment designs.

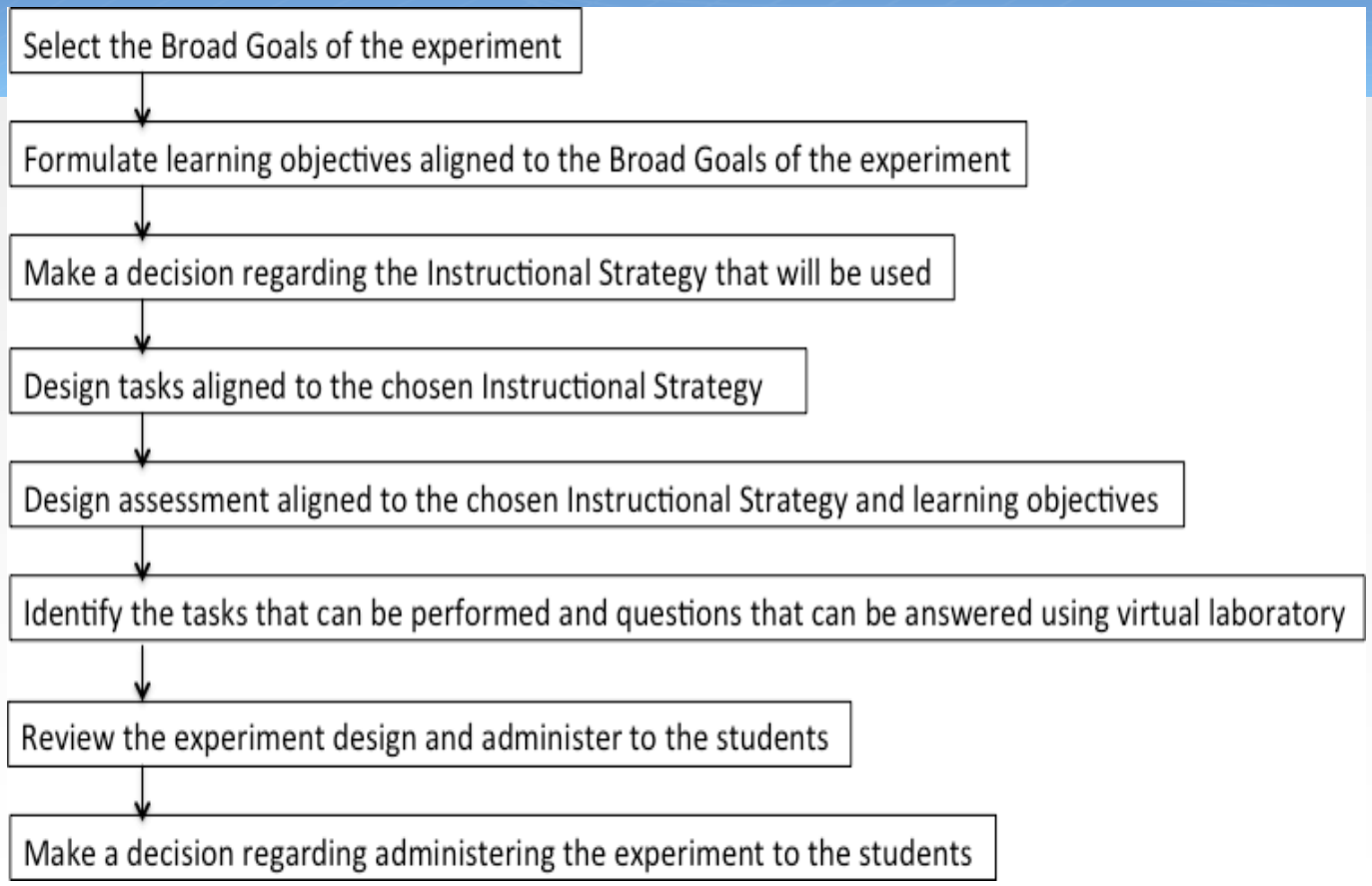
Scientific Design of laboratory experiments

The quality of the experiment designs can be improved if the Engineering Instructors design

- Student centered effective experiments
- Based on scientifically proven instructional strategies
- Exploiting the features of virtual labs

This systematic design of experiments is the Scientific Design of laboratory experiments.

Steps in the Scientific Design of laboratory experiments



We will be discussing each of these steps in a series of videos uploaded at the respective page of the SDVIcE tool. Each video and the corresponding guidelines will help you in understanding the particular step and implementing it so that you can design effective virtual laboratory experiments for your course.

There are nine sets of guidelines as given in the next slide.

Virtual Laboratory Experiment Design Guidelines (VLEDG)

- Set I - Selection of broad goal of the experiment
- Set II - Formulation of learning objectives
- Set III - Experiment design at different difficulty levels with Expository Instructional Strategy
- Set IV - Experiment design incorporating active learning methods with Expository Instructional Strategy
- Set V - Experiment design with Discovery Instructional Strategy
- Set VI - Experiment design with Well Structured Problem Solving Instructional Strategy
- Set VII - Experiment design with Problem-based Instructional Strategy
- Se VIII - Design of authentic assessment
- Set IX - Selection of suitable virtual laboratory