

Laboratory Work - what is its goal?

A workshop held at the 1st Annual Foundation year Network Meeting
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Laboratory and practical work could be divided into 3 broad classes, although the boundaries between them are fuzzy and a session of laboratory or practical work might involve a series of tasks, each falling into a different class.

1. Testing Tasks

These were defined as tasks where the students were given or had previously learnt a theoretical concept. The aim of the practical session was to allow them to observe that concept in action.

Useful for teaching: How to use standard equipment; Understanding of a law or process; How to handle experimental error; How to record observations or results and keep accurate records in accepted formats; Understanding of the limitations of experiment.

Strengths: Good for reinforcement and consolidation of theoretical material; Improve accuracy and confidence of students; Encourage debate regarding sources of error/anomalies.

Weaknesses: May be boring; May not encourage creativity.

Example tasks: Test the effect of contact area on the coefficient of friction; Determine the water potential in a plant; How to titrate.

2. Observational Tasks

These were defined as tasks where the students had to observe a process and derive the related law. The aim of the practical session was to let them develop a theory or conceptual view.

Useful for teaching: Classification techniques; Experimental method; Subject specific facts; Understanding of theory; Effect of change in a parameter/variable; Use of standard equipment; Critical analysis & evaluation; Data analysis.

Strengths: Gives “hands on” experience; Leads to analysis of cause/effect; Promotes experiential learning; Encourages students to think “Why?”

Weaknesses: Students may obtain poor results or fail to develop intended skills leading to loss of confidence and/or motivation; Students need help to evaluate things that don't work if they are to learn from them; Students operating on false assumptions may not develop good intuition.

Example tasks: Extracting DNA from a kiwi fruit; Finding the chemical composition with respect to carbohydrates/lipids/proteins of solutions X. Y etc; Determining the relationship between stress and strain for a material.

3. Planning/Designing Tasks

These were defined as tasks where the students were given a fairly loosely posed question and were expected to define the experiment and design the protocol.

Useful for teaching: Presentation/Communication skills; Problem solving; Group work skill; Peer marking/review; Time management; Trouble shooting.

Strengths: Encourages students to use a range of learning resources; Encourages independent learning; develops reasoning skills; Enhances peer support

Weaknesses: Students can easily get “off track” and fail to learn from the experience

Example tasks: Design a hair dryer; The effect of inhibitors on photosynthesis; What happens to soup if you leave it lying around?

For Foundation Year students most examples of lab work seemed to fall into the *Observational* category. This was perceived to offer the best balance between engagement and the ability to guide students to a productive outcome. The value of *Testing* tasks was recognised, particularly for teaching standard scientific techniques. There was much interest in *Planning/Designing* Tasks for Foundation Year. Some programmes used short projects or incorporated design aspects into practical work in some way. It was noted that students at this level needed a well-designed framework in which to conduct these kinds of tasks and that it was beneficial for them to have some training in information retrieval and evaluation before extended free-form tasks were embarked on. In this respect, some participants in the workshop felt it may be helpful to think in terms of a spectrum of increasing difficulty or *learner independence* which moves from testing to observational to planning/design tasks. If this is accepted, then there may be a case for introducing the different types of task gradually over an academic year, or else for ensuring that any planning/design tasks introduced early in the academic year are more carefully guided/supported.

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