

# The role of practical work in the teaching and learning of science

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# Question 1

Outline your definition of labwork and the analytic framework that drives this definition? Under this definition, what distinguishes labwork (or practical work) from other aspects of instruction in science? How does inquiry fit into your definition?

# Definition

‘practical work’: any teaching and learning activity which involves at some point the students in observing or manipulating real objects and materials.

# In pursuit of the following aims:

- to help students to gain an understanding of as much of the established body of scientific knowledge as is appropriate to their needs, interests and capacities;
- to develop students' understanding of the methods by which this knowledge has been gained, and our grounds for confidence in it (knowledge *about* science).

# Analytic framework

- Cognitive viewpoint
  - student's task is to construct a mental representation of the world
- Applicable to both practical and non-practical tasks
- Definition would include inquiry

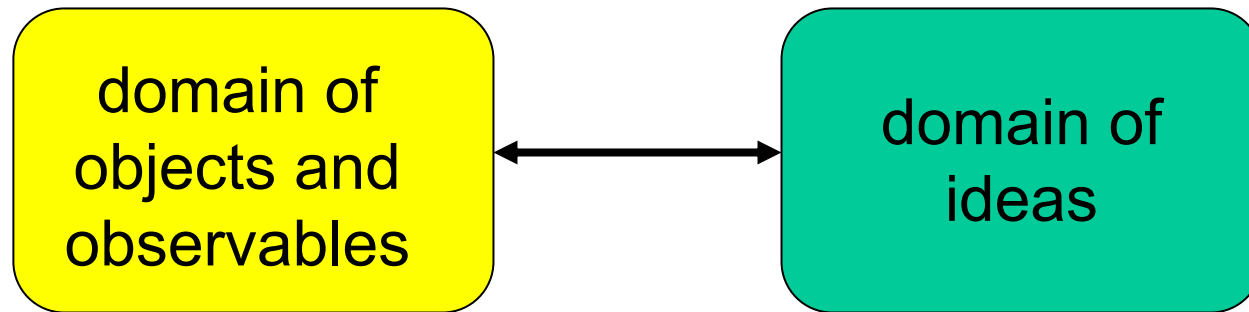
## Question 2

What is the role of laboratory experiences (practical work) in supporting various goals for students' learning in science? For example, does the role of laboratory experiences change if learning of science content is higher priority than learning about the nature of science or the scientific method?

# Learning science content

- Augmenting students' experience of phenomena
  - mainly in domain of objects/observables
- Acting on the world in the light of a model or theory
  - linking the two domains of objects/observables and of ideas

# Two domains of knowledge



For some practical tasks, learning objectives are mainly in the domain of objects and observables (easier).

For others, learning involves making links between the two domains (harder).

# Learning science through enquiry

- Difference between research laboratory and teaching laboratory
  - and between research scientists and students trying to grasp established ideas
- When used to develop students' scientific knowledge, practical work is a communication strategy

# Learning *about* science

- Tacit knowledge
  - experience of carrying out more open-ended investigations
  - from practical tasks intended to teach scientific knowledge
    - ‘messages’ may be different
- Declarative knowledge
  - from practical tasks with specific objectives

## Question 3

What unique role do laboratory experiences play in supporting students' learning in science? What would be the consequences for students' learning of science content if laboratory experiences were eliminated? What would be the consequences for students' learning about the nature of science?

# Unique role?

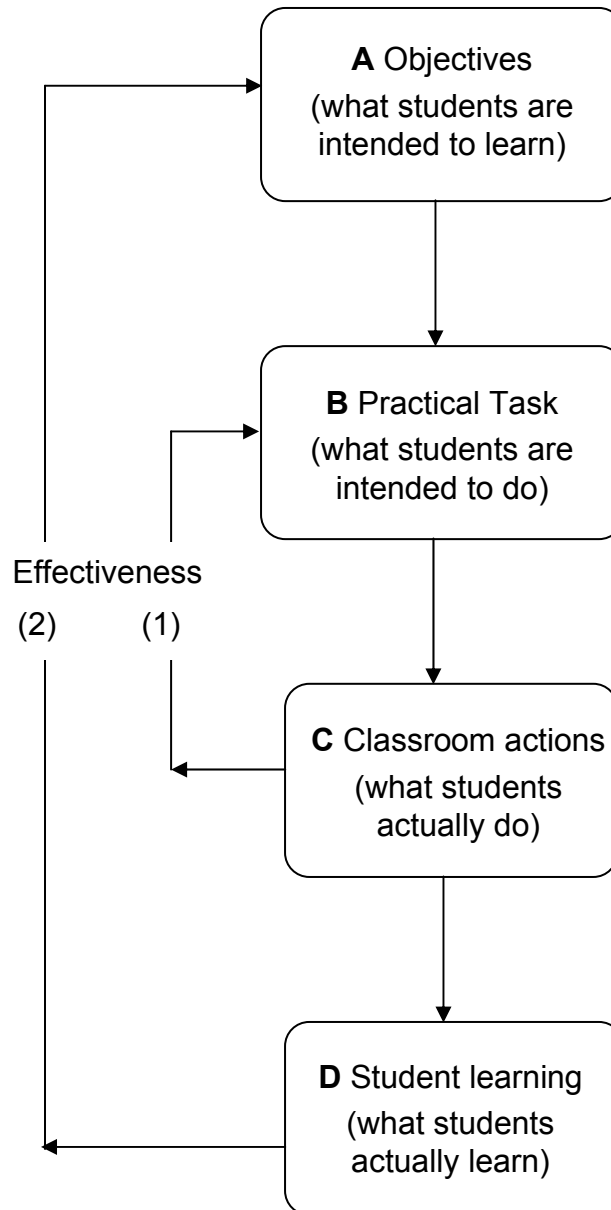
- Direct observation of the world, leading to increased knowledge of it
- Development of understanding through acting on the world
- Understanding of key issues of data collection and interpretation

# Some consequences of omission

- Poorer knowledge of phenomena and materials
- Weaker grasp of explanations, models, theories
- Little 'knowledge-in-action' of how to carry out an enquiry 'scientifically'
- Reduced ability to evaluate given data critically.

## Question 4

What factors must be considered in determining the effectiveness of laboratory experiences? To what extent is it possible to derive a common set of characteristics of “good or effective” lab experiences that hold true across a range of different learning goals and content areas?



# Thinking about the effectiveness of practical work

# Effective practical work

- Clear learning objectives
- Not too many
- Focussed, avoiding 'noise' and clutter
- Designed to get students thinking **before** starting the practical task
- Strategy for 'scaffolding' students' thinking if domain of ideas is heavily involved
- Clear-headed about the fact that it is a communication, not 'authentic' enquiry.