

# BEYOND THE LEARNER: REFRAMING PLANNING-PHASE CHALLENGES IN OPEN INQUIRY-BASED LEARNING AS STRUCTURAL BARRIERS

## BACKGROUND & RATIONALE

### Open Inquiry-Based Learning (oIBL) in Chemistry

- oIBL enables students to construct scientific knowledge through self-directed investigation [1,2].
- Success depends critically on the planning phase [3,4].
- Challenges are conventionally attributed to student deficits in competency, knowledge, or motivation [5,6].
- The PlanFoL project reframes these as object-related barriers [5,6].

#### Deficit perspective

Student lacks skills, knowledge, or motivation



#### Systemic perspective

Barrier is located in the task/subject-matter structure

## RESEARCH QUESTIONS

### Guiding the study

- RQ1** What are the object-related barriers of activities [A1]–[A3] in the planning phase of oIBL?
- RQ2** How can the identified object-related barriers be addressed through scaffolding materials in chemistry laboratory settings?

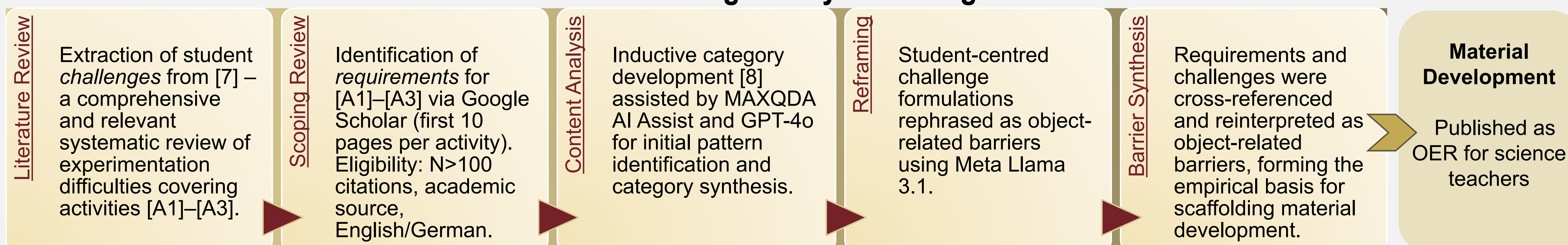
Addressing these questions enables the development of inclusive, targeted scaffolding materials for chemistry laboratory contexts.

#### Three core planning activities

- A1** Generating the research question
- A2** Formulating a theory-driven assumption or hypothesis
- A3** Planning an appropriate investigation

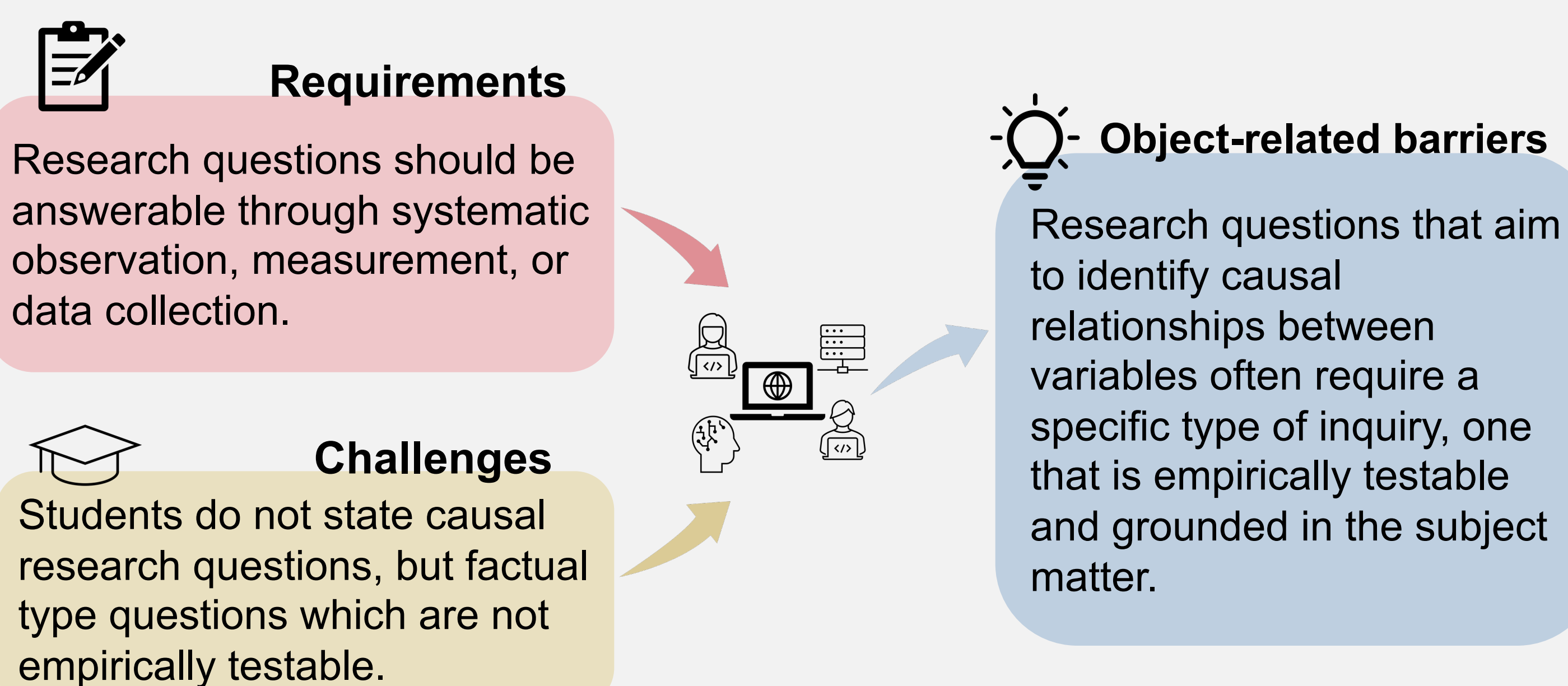
## METHODOLOGY

### A Multi-Stage Analytical Design



## RESULTS

### Example: Generating the research question



### Practical implementation: CO<sub>2</sub> Impacts & Uses

Three barrier-targeted materials were developed in four design-based research cycles and trialled in a Grade 9 inquiry setting:

- 1. Documentation sheet:** [A1] Prompt separates exploration from question formulation, guiding students toward causal, empirically testable questions.
- 2. Information cards:** Photo, illustration, label, and purpose for each piece of equipment, communicating about the materials and supporting investigation planning.
- 3. Preparatory materials:** Video introducing CO<sub>2</sub> properties and the inquiry cycle, activates prior knowledge before open inquiry begins.



Fig. 1: Example of materials available to learners.

## CONCLUSION

Many barriers encountered by students in the chemistry laboratory planning phase are **not primarily located in students** — they are structural properties of the inquiry tasks themselves. Observing challenges and reframing these as object-related barriers enables the design of **targeted, inclusive scaffolding** that supports all learners to participate meaningfully.

