Assessing whether CUREs meet research and pedagogical goals

Sara E. Brownell
Assistant Professor
School of Life Sciences
Arizona State University
Course-based undergraduate research experiences (CUREs):
Research embedded in a lab course

Research is the defining feature of a CURE:
Producing novel findings that are broadly relevant to people outside the classroom
Backward design approach

What are my goals for the CURE?
Backward design approach

What are my goals for the CURE?

How do I assess the CURE to see if it is achieving my goals?

Wiggins and McTighe 1998
Backward design approach

What are my goals for the CURE?

How do I assess the CURE to see if it is achieving my goals?

How do I design the CURE to meet my goals?

Wiggins and McTighe 1998
Define Your Goals Before You Design a CURE: A Call to Use Backward Design in Planning Course-Based Undergraduate Research Experiences

Katelyn M. Cooper¹, Paula A. G. Soneral², and Sara E. Brownell¹*

¹Biology Education Research Lab, School of Life Sciences, Arizona State University, Tempe, AZ 85281,
²Biological Sciences, Bethel University, St. Paul, MN 55112
Backward design approach

What are my goals for the CURE?

How do I assess the CURE to see if it is achieving my goals?

How do I design the CURE to meet my goals?

Wiggins and McTighe 1998
What are my goals for the CURE?

**Pedagogical goals**

What do you want students to know and be able to do?

By choosing to teach a CURE, instructors have already defined the overarching learning goal for students:

To provide them with the experience of **conducting scientific research**

Research: produce novel, broadly relevant findings

**Research goals**

What are your scientific discovery milestones?

Cooper, Soneral, Brownell 2017
**Pedagogical goals**

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge  
(e.g. what is PCR, what is research)

Process skills  
(e.g. design an experiment, analyze data, communicate results)

Psychosocial gains  
(e.g. increase sense of belonging in science)

**Research goals**

What are your scientific discovery milestones?

What is the scientific research question?

Produce data that lead to publication

Produce data that inform local decision making

Collect pilot data for a grant or future project
Pedagogical goals

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge
(e.g. what is PCR, what is research)

Process skills
(e.g. design an experiment, analyze data, communicate results)

Psychosocial gains
(e.g. increase sense of belonging in science)

Research goals

What are your scientific discovery milestones?

What is the scientific research question?

Produce data that lead to publication

Produce data that inform local decision making

Collect pilot data for a grant or future project

Tensions between pedagogical and research goals
**Pedagogical goals**

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge (e.g. what is PCR, what is research)

Process skills (e.g. design an experiment, analyze data, communicate results)

Psychosocial gains (e.g. increase sense of belonging in science)

---

**Research goals**

What are your scientific discovery milestones?

What is the scientific research question?

**Produce data that lead to publication**

Produce data that inform local decision making

Collect pilot data for a grant or future project

---

**Tensions between pedagogical and research goals**
Pedagogical goals

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge
(e.g. what is PCR, what is research)

Process skills
(e.g. design an experiment, analyze data, communicate results)

Psychosocial gains
(e.g. increase sense of belonging in science)

Research goals

What are your scientific discovery milestones?

What is the scientific research question?

Produce data that lead to publication

Produce data that inform local decision making

Collect pilot data for a grant or future project

Tensions between pedagogical and research goals
Pedagogical goals

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge (e.g. what is PCR, what is research)

Process skills (e.g. design an experiment, analyze data, communicate results)

Psychosocial gains (e.g. increase sense of belonging in science)

Research goals

What are your scientific discovery milestones?

What is the scientific research question?

Produce data that lead to publication

Produce data that inform local decision making

Collect pilot data for a grant or future project

Tensions between pedagogical goals
**Pedagogical goals**

What do you want students to know and be able to do?

**Engage students in research**

- Technical skills
- Conceptual knowledge (e.g. what is PCR, what is research)
- Process skills (e.g. design an experiment, *analyze data*, communicate results)
- Psychosocial gains (e.g. increase sense of belonging in science)

**Research goals**

What are your scientific discovery milestones?

- What is the scientific research question?
- Produce data that lead to publication
- Produce data that inform local decision making
- Collect pilot data for a grant or future project

---

**Tensions between pedagogical goals**
**Pedagogical goals**

What do you want students to know and be able to do?

Engage students in research

Technical skills

Conceptual knowledge (e.g. what is PCR, what is research)

Process skills (e.g. design an experiment, analyze data, communicate results)

Psychosocial gains (e.g. increase sense of belonging in science)

**Research goals**

What are your scientific discovery milestones?

What is the scientific research question?

Produce data that lead to publication

Produce data that inform local decision making

Collect pilot data for a grant or future project

**Which goals are most important? What is the hierarchy of goals?**
Backward design approach to designing CUREs

What are my goals for the CURE?

How do I assess the CURE to see if it is achieving my goals?

How do I design the CURE to meet my goals?

Wiggins and McTighe 1998
Cooper, Soneral, Brownell 2017
How do you choose which assessment strategy to use?

• Is there alignment with goals?
  – Does your assessment actually measure that goal?

• How good is the assessment?
  – Has someone else used it? Has there been any validation? Are you using it in the way that it was intended to be used?

• Is it feasible to use?
  – Do you have the time/expertise to collect and analyze the data?
• Organized a list of “off the shelf” assessments that you could use to assess your CURE that focus on student gains

• But if these assessments don’t align with your goals, then don’t use them
One size does not fit all for assessment

• We are beginning to move away from fishing for CURE outcomes to more purposefully designing CUREs to meet specific outcomes and setting out to measure those outcomes
Backward design approach to designing CUREs

What are my goals for the CURE?

How do I assess the CURE to see if it is achieving my goals?

How do I design the CURE to meet my goals?

Wiggins and McTighe 1998
Cooper, Soneral, Brownell 2017
How do I design the activities in the CURE to meet my goals?

• What aspects of a CURE lead to achieving goals?
  – We need more reductionist research to identify what features of a CURE can lead to outcomes
  – Need more backward designed studies!
Backward design approach to designing CUREs

What are my goals for the CURE?
How do I assess the CURE to see if it is achieving my goals?
How do I design the CURE to meet my goals?

Wiggins and McTighe 1998
Cooper, Soneral, Brownell 2017