

## Comparing the Pedagogical Strategies of Teachers Who Co-Designed Units to Support Students' Theory Building

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**Abstract:** Co-design is a collaborative approach intertwining individuals' unique perspectives resulting in a product that holds creative stakes for all parties. In this paper, we focus on two teachers who co-designed a unit to engage students in theory-building practices and explore similarities and differences in strategies. Through preliminary analysis of classroom video data, we identified six pedagogical strategies teachers enacted including *technology use*, *lesson introduction*, *whole-class discussion facilitation*, *monitoring*, *addressing questions*, and *wrapping up the lesson*.

### Introduction

Co-design is an approach to collaboratively creating innovative interventions with researchers and teachers that addresses both practical and theoretical aspects of learning (Roschelle et al., 2006). The value of co-design in these cases is the recognition of the classroom context and teachers' needs while creating interventions, as research shows that teachers' contexts and practices are highly influential in the adoption of learning innovations (Penuel et al., 2007). Yet, how these designs are taken up in context may vary from teacher to teacher, as they have different pedagogical strategies and classroom norms that affect how they teach collaborative lessons (Kaendler et al., 2015). In this study, we describe two teachers' pedagogical strategies during a lesson they created together. We argue that units co-designed with the teachers who implement them are often operationalized differently in practice. We explore teachers' pedagogical strategies to understand how teachers enact innovative units and identify potential strategies that we can intentionally build on in future design iterations.

### Theoretical and empirical foundations

Pedagogical strategies are the moves that teachers enact to support learning in their classrooms (Leat & Higgins, 2002). Teachers take up different strategies to support interactions during collaborative activities that differ based on their experiences, beliefs, and goals (Kaendler et al., 2015). Pedagogical strategies, such as monitoring or intervening, are important for collaborative learning because the quality of these strategies can impact groups' interactions (Hoffman & Mercer, 2016). However, research shows that pedagogical strategies that support productive collaborative learning require intentionality and training (Kaendler et al., 2015). This becomes more challenging when teachers are implementing interventions that are new to them. The focus of our co-design was to create a unit that incorporated students' ideas within the teachers' existing curricula, therefore, there was no explicit emphasis on how they might use different pedagogical strategies to support groups' collaboration. Therefore, we ask the research question, *how do teachers who co-design a series of classroom units together enact different pedagogical strategies in their implementations of those units?*

### Methods

This study focuses on data from the implementation of a one week-long lesson, implemented by two 8th grade science teachers, Katie and Rebecca. In the lesson, "can crush," students dropped a bottle filled with variable amounts of water (mass) from varying heights, watching as it crushed an empty aluminum pop can on the floor. They recorded the height of the can, post-crush, and compared the amount of can-crush with the initial drop height and amount of water in the bottle. Following each investigation, students responded to questions asking them to make sense of and model the relationships between the initial height/mass of the dropped objects, and the outcomes they resulted in. A total of 60 students consented and participated in the study across both classrooms. We collected video data of the groups and the teachers' interactions during the lesson. To analyze the data, the video data was reviewed and described through content logging (Mayring, 2014). Content logs were compartmentalized into time intervals of two minutes; we then conducted thematic analysis and identified six pedagogical strategies (Braun & Clarke, 2012).

### Findings

Although six pedagogical strategies were identified in both classrooms, Katie and Rebecca operationalized them differently during the lesson. For instance, *technology use* in Katie's class was limited and students only used their Chromebooks to take a quiz at the beginning of class and used paper-and-pencil to document progress for the remainder of class; *technology use* in Rebecca's class differed drastically as students used their Chromebooks

to work on and document their progress for the entire class period. We summarized the similarities and differences of the six pedagogical strategies used by Katie and Rebecca during the “can crush” activity (see Table 1).

**Table 1**  
*Pedagogical strategies by teacher.*

Strategies	Strategy Definition	Katie’s Strategy Examples	Rebecca’s Strategy Examples
Technology Use	How teachers used technology	Students used paper-and-pencil worksheets	Students used Chromebooks to fill out worksheets imported from Canvas and Google Docs
Lesson introduction	How the teachers introduced the lesson	Less direct instruction, but scaffolded with information from past lessons	Gave highly structured instructions in the beginning
Whole-Class Discussions	Class discussion before and after lesson	Students raised their hands to answer questions	Called on students randomly, but with some hand raising
Monitoring strategies	How teachers observed students’ progress	Silently observed student progress	Monitored student progress, gave reminders about documenting experiment
Addressing questions	How teachers responded to students questions	Provided direct clarifying responses to questions	Prompted students to ask group members about their answers
Wrap strategies	How teachers concluded their class	Structured wrap-up with lesson goal and clean-up	Left the class with questions to think about the next day

## Discussion

In this study, we explore how two teachers who co-designed a unit together implemented that unit using different pedagogical practices. Six themes were identified that we classified as pedagogical strategies including how Rebecca and Katie *used technology, introduced the lesson, engaged in whole class discussions, monitored, addressed questions, and wrapped up the lesson*. While Katie and Rebecca co-designed the unit together, they both have their unique classroom norms and teaching strategies, which informed how they supported students’ collaborative theory building, mirroring findings in the literature (Kaendler et al., 2015). We emphasize that there is no right or wrong way to enact these pedagogical strategies, rather we are exploring the range of strategies to inform how we might iterate on this unit in the future. As a design-based research project engaging in co-design, we will leverage Katie and Rebecca’s pedagogical strategies that emerged in the unit, as well as their post-implementation interviews to iterate on them and create new strategies to support groups in the classroom.

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