

## Summary

The promise of the Next Generation Science Standards (NGSS Lead States, 2013) rests on teachers creating instructional experiences where students are highly engaged and active in their learning. This collaborative project uses co-design as a strategy to develop a professional learning approach with resources to assist middle school teachers in supporting students' motivation and engagement in the context of NGSS instruction. The project brings together motivation experts, science education researchers, and middle school science teachers. The team is using a design-based research methodology to iteratively design and study the intervention and its features.

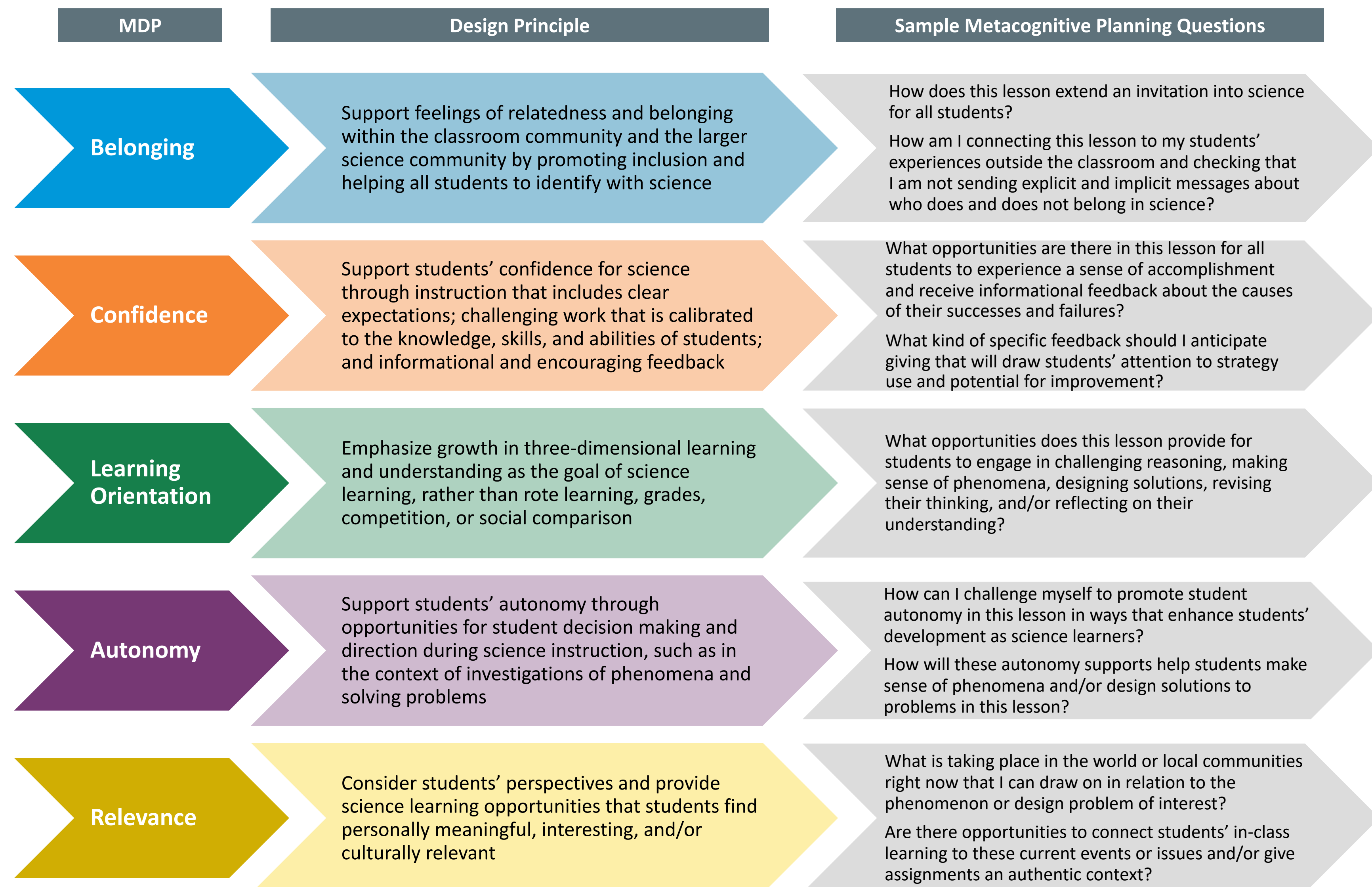
## Overview

**M-PLANS** (Motivation - Planning Lessons to Activate eNgageMENT in Science) refers to a suite of professional learning tools to facilitate middle school science teachers' modification, creation, and implementation of instruction that supports students' motivation and engagement along with the science and engineering practices, crosscutting concepts and disciplinary core ideas specified in the NRC Framework (NRC, 2012) and NGSS. M-PLANS is being co-developed in collaboration with experienced science teachers and school district science coordinators through a cyclical co-design process (see Co-Design Process Figure).

The project aims to co-develop a professional learning experience that enhances teachers' pedagogical content knowledge about a variety of motivational competencies that are implicit in the Framework and NGSS and to equip them to support student motivation using five theoretically- and empirically-based Motivational Design Principles (MDPs; Linnenbrink-Garcia, Patall, & Pekrun, 2016).

Primary research questions focus on providing formative feedback on M-PLANS: (1) How do teachers respond to M-PLANS? and (2) How do students respond to instruction developed by their teachers through M-PLANS?

## Motivation Design Principles for Science Instruction



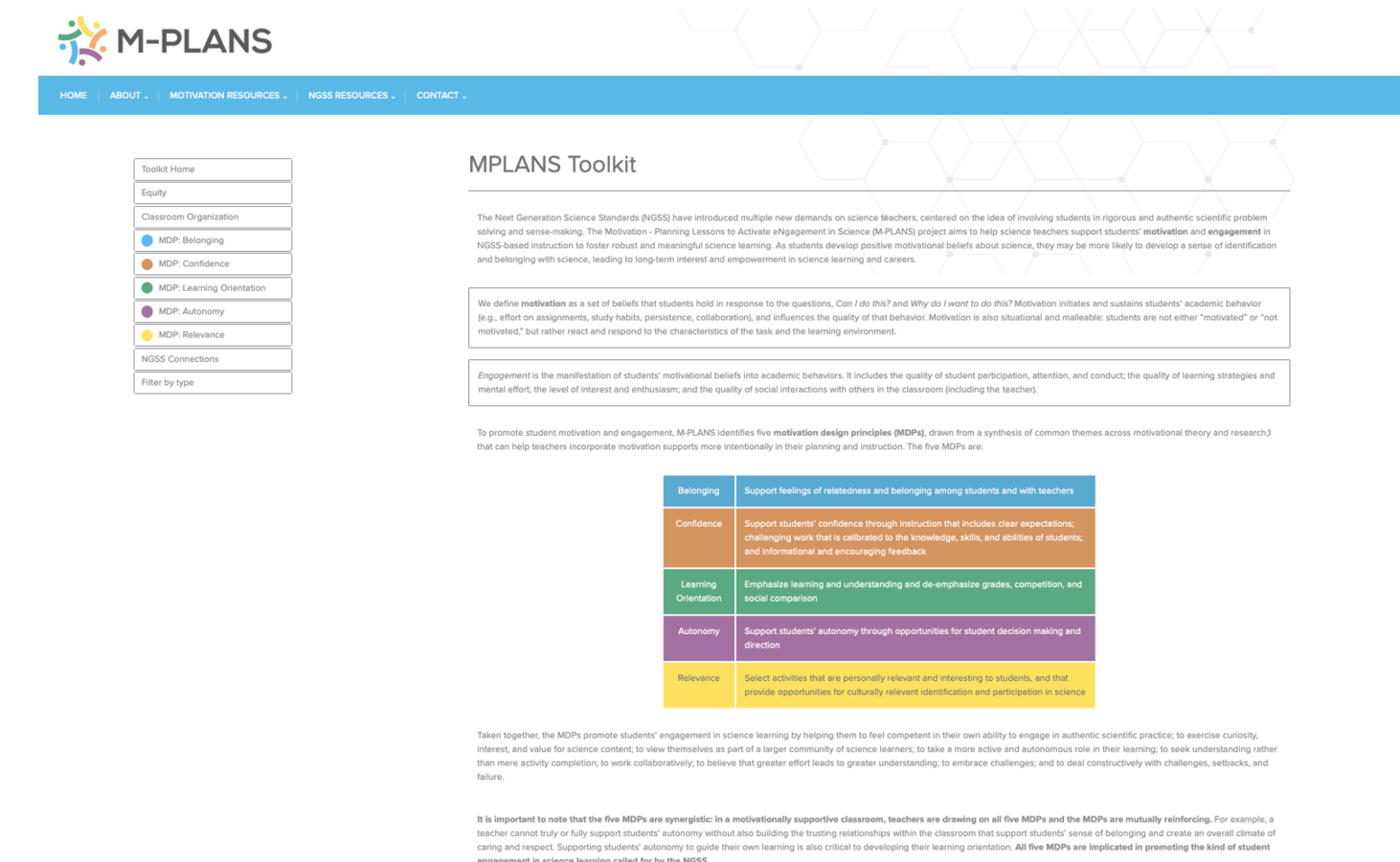
## Tool Development

**M-PLANS PL Approach:** Focused on facilitating teachers' understanding of 5 MDPs

- In-service teachers attend a 3-day summer workshop where they learn about the 5 MDPs and their alignment with NGSS-based instruction
- In-service teachers re-design and teach a science unit based on MDPs to support students' engagement and learning in NGSS-aligned instruction
- Formative feedback during workshop and unit enactment encourages reflection and shifts in educational practice

Co-design process shaped the content and focus of the PL:

- Added more concrete examples, talk-moves, role-play examples
- Refined MDP terms and approach to instruction to address misconceptions



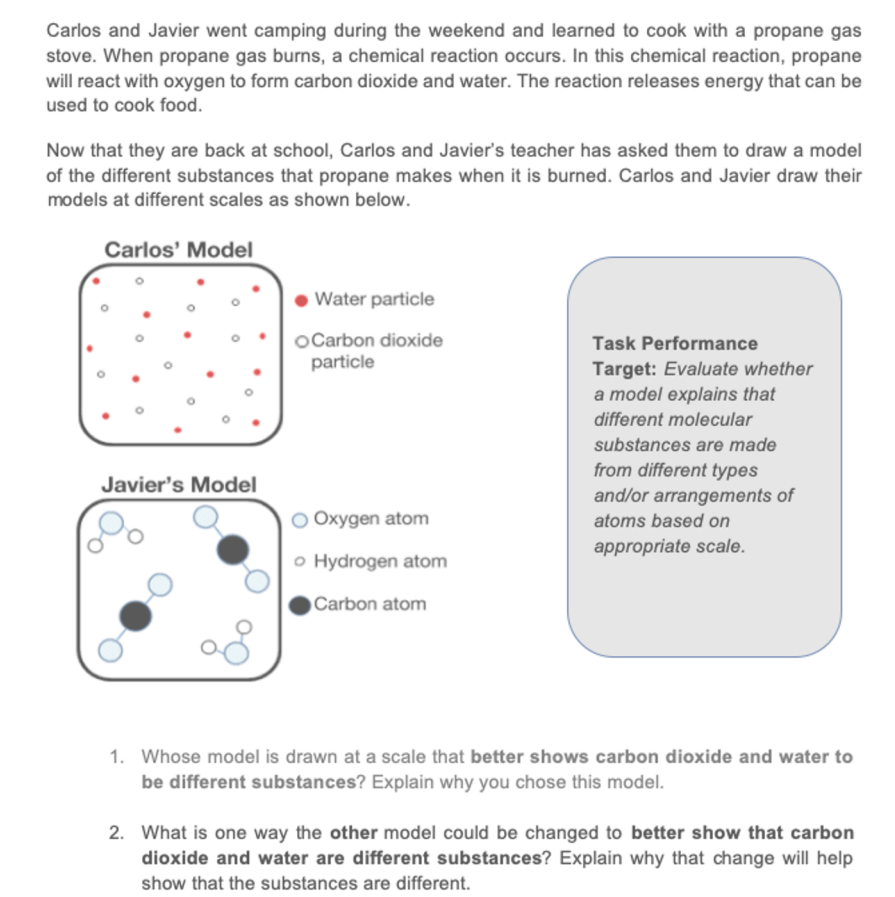
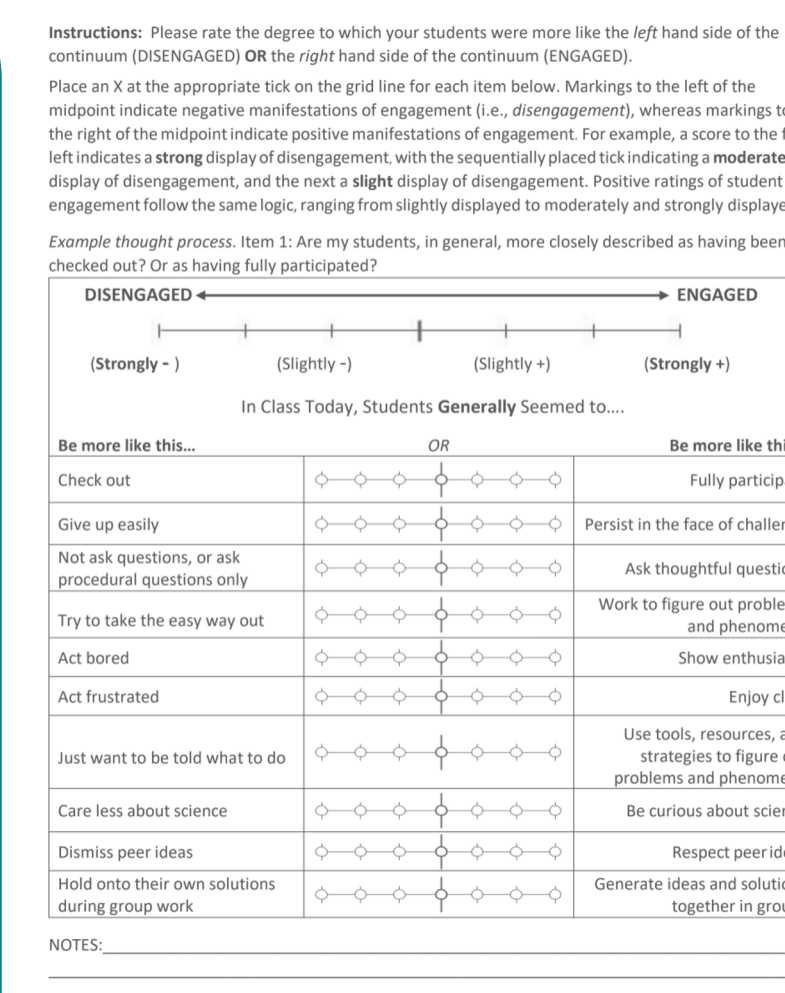
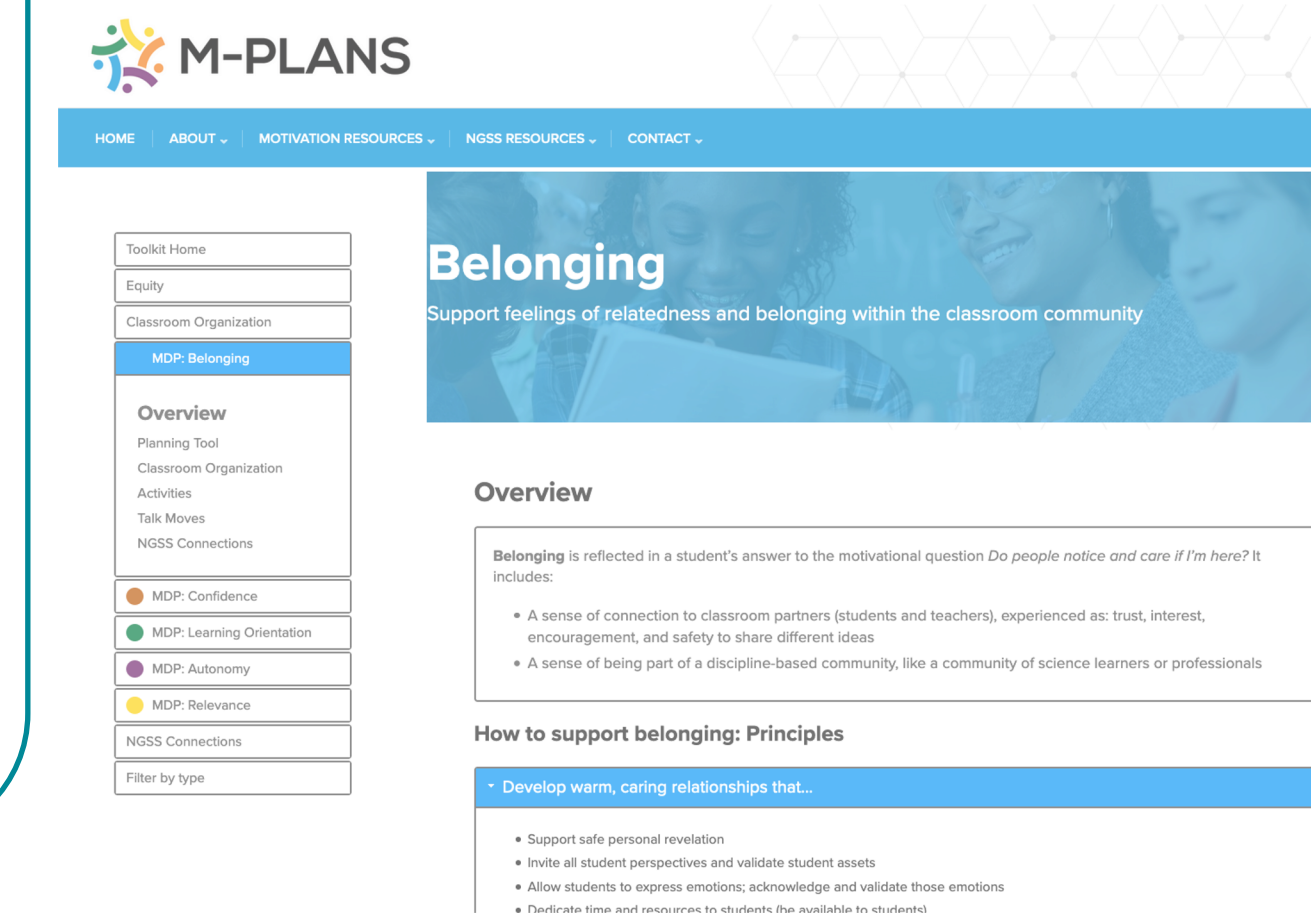
**M-PLANS Toolkit:** Suite of materials (print and web-based) for teachers to plan and enact motivationally-supportive NGSS lessons.

- Each MDP section includes: Overview, Look-Fors, Planning Tool, Activities, Talk Moves
- Also includes sections on: (1) Equity, (2) establishing a Positive Classroom Climate, (3) Connections between NGSS and the MDPs, (4) re-imagined Planning Tool

Co-design process led to the development of a comprehensive toolkit to provide concrete examples and easy-to-reference tips.

**REACT:** A checklist for teachers to gauge students' engagement (at the class level) after teaching a lesson.

- Checklist enables teachers to take the "temperature" of their classroom and promotes reflection
- Co-design process shaped initial development of two versions, which were tested during initial implementation
- Used along with student end-of-class reports of engagement (ECR) to provide feedback on instructional practices and planning during co-design teacher implementation



**Knowledge-in-Use (KiU) Assessments:** Three-dimensional tasks drawn from the design work of the Next Generation Science Assessment Project (Harris et al., 2019):

- Tasks integrate aspects of disciplinary core ideas, science and engineering practices, and crosscutting concepts
- Contextualized in scenarios presented in a succinct story format
- Each task includes prompts to elicit proficiency in the targeted aspects of the 3-dimensions

Co-design process shaped item refinement for improving accessibility for diverse student populations.

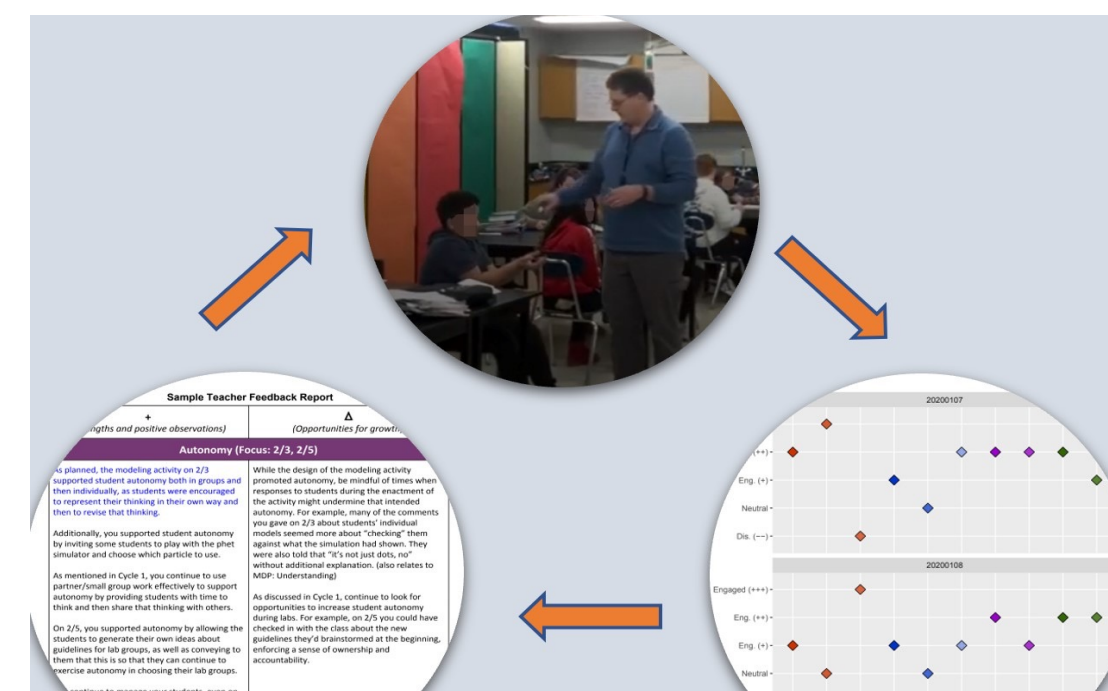
## Co-Design Process

### Co-design Teacher PL



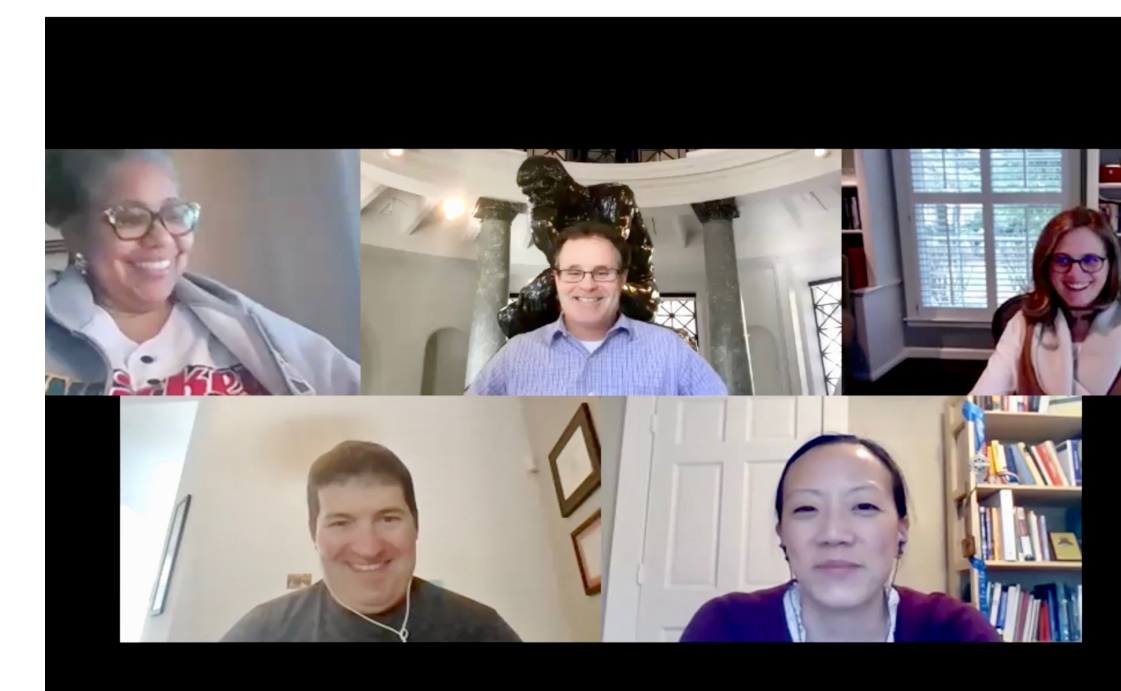
Summer 2019: Initial rollout of 3-Day PL with co-design teachers, science coordinators, and research team

### Co-design Teacher Implementation



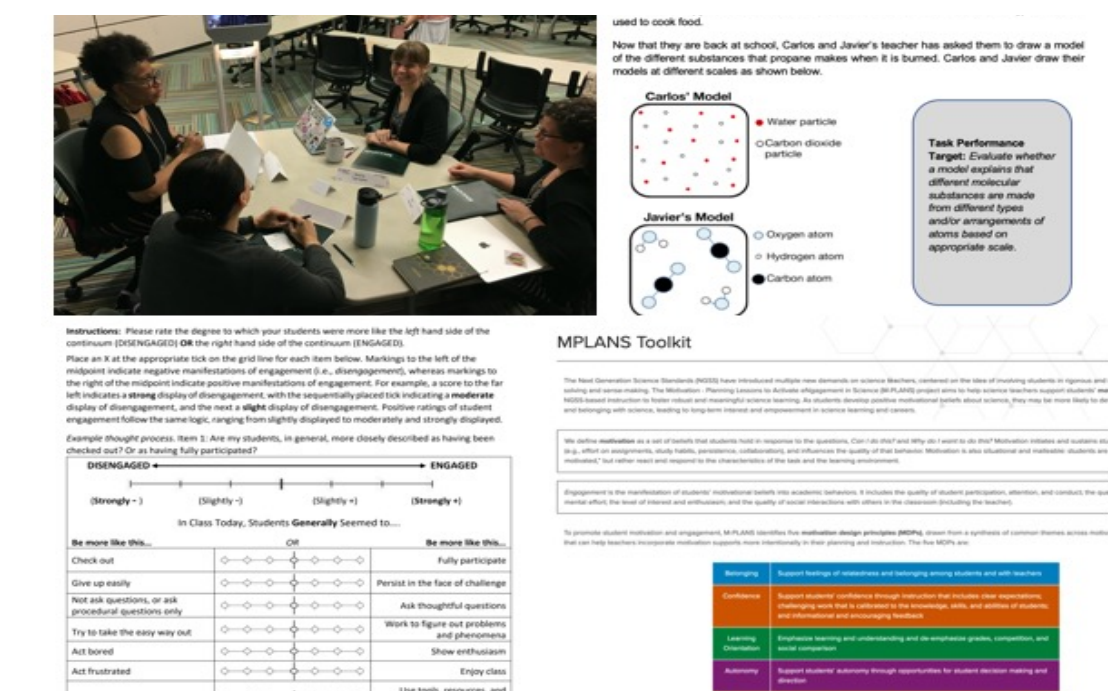
Fall 2019 – Winter 2020: Six co-design teachers implemented re-designed unit; received iterative feedback from co-design teachers and research team throughout implementation cycle

### Co-design Team Spring Institute



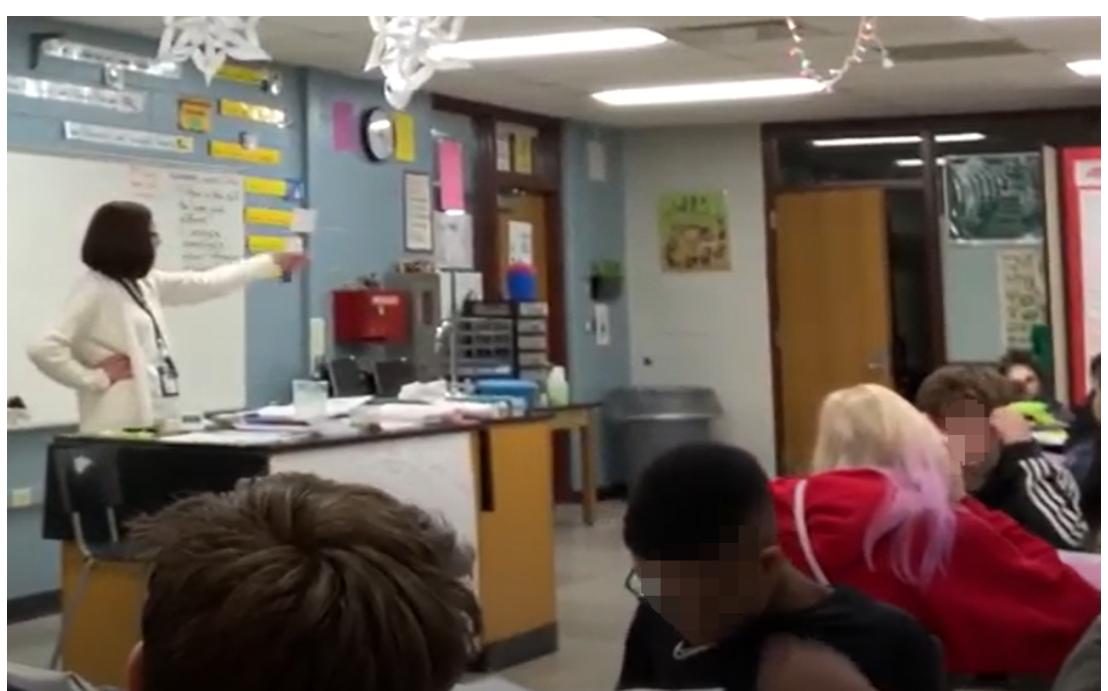
Spring 2020: Co-design teachers and research team evaluated implementation and proposed re-design of M-PLANS tools

### Tool Revision



Summer 2020 – Summer 2021: Iterative revision of suite of M-PLANS tools with feedback from co-design teachers and science coordinators

### Rollout PL



Planned Summer 2021 – Fall 2021: Roll-out of revised PL (including science unit implementation) with new group of in-service middle school science teachers