Integrated STEM Professional Development: Utilizing Best Practices in an Online Format

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Outline

Virtual Professional Development (PD) in iSTEM

- Designed using Desmione's Five Critical Features of PD
- Based on three dimensional learning model
- Targeting sources of self efficacy
- Synchronous and asynchronous components

Background

- Elementary school teachers often have low self-efficacy in teaching science (e.g., Brobst et al., 2017) and engineering (Hammack & Ivey, 2017)
- Many elementary teachers find their preservice teacher preparation does not prepare them to teach:
  - science (Banilower et al., 2018; Gess-Newsome, 1999; Trygstad et al. 2013)
  - engineering (Banilower et al., 2018; Custer & Daugherty, 2009; Reimers et al., 2015)

Self-Efficacy

- Self-efficacy predicts motivation and performance (Bandura, 1982; Pajares & Schunk, 2001), and is linked to:
  - Teacher effectiveness, persistence, and retention (e.g., Lakshmanan et al., 2011; Sang et al., 2012)
  - Commitment to teaching profession (Yost, 2006)
  - Teacher competence and decision making (Bandura, 1997)

Professional Development (PD)

- **participatory culture** allowing for adequate time to grapple with ideas and materials (Little, 1993)

- **interactive**, social and based in a community of practice (Desimone 2011)

- Online PD can be **synchronous**, where learning happens in real time, asynchronous, where teachers engage in their learning on their own time, or a hybrid of both synchronous and asynchronous (Elliott, 2017).

Professional Development (PD)

- **social presence**: interactions can take many forms including sharing work, asynchronous discussions, and real-time conversation (Holmes, Signer, & MacLeod, 2010).

- promote **ownership** as teachers determine valuable content (Darling-Hammond, Hyler, & Gardner, 2017; Macias, 2017)

Key Features of the Online PD

- Critical feature of online PD is instructor facilitation. Multiple studies highlight the importance of instructor facilitation for fostering productive interactions among teachers (Watkins, 2020)

- Online PDs may more efficiently afford and support teacher learning and professional practice while addressing the issues listed above along with other factors related to scalability, cost, and accessibility, while even reaching learners in isolated populations (Alqarni, 2015; Marrongelle et al., 2013).

Key Features of the Online PD

Desimone's (2009) five critical features:

1. content focus,
2. active learning,
3. coherence,
4. duration, and
5. collective participation.

How many hours?

- Some studies have found positive outcomes with as few as **11 contact hours** (Piasta et al.,2010) and studies with more than 65 contact hours (Garet et al., 2010)

- Estrella et al. (2018) analysis of over 26 studies found that PD programs with greater than **15 hours** showed positive significant treatment effects when compared with shorter durations (Estrella et al., 2018).

What did we do?

- **Barriers for online PD:** family time, vacation, travel time and the amount of time needed to attend the workshops
- **Our sustainable solution**: Summer Institute was held synchronous over 2 days with **3 contact hours** each day and one asynchronous day in between.

Summer PD Activities

Career Brain Dump

Enter STEM careers in the Jamboard.

How many different careers can we list?

Are there any patterns in what is represented (or not represented) in our list of careers?

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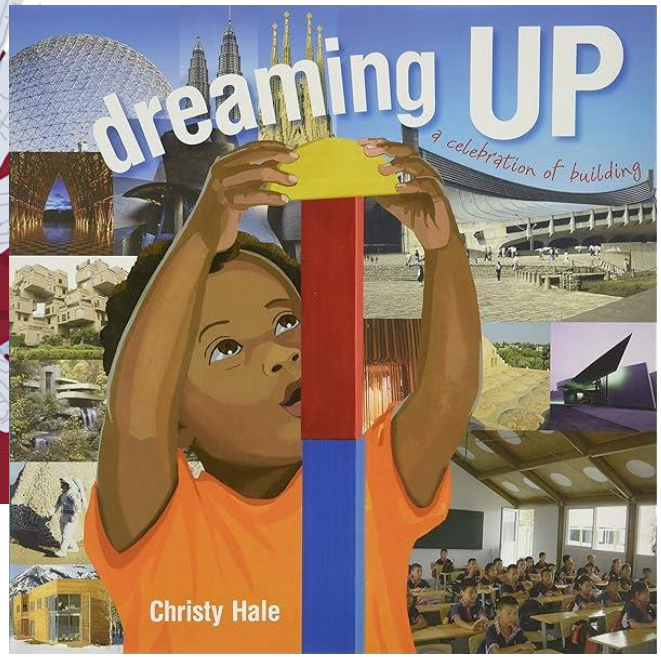
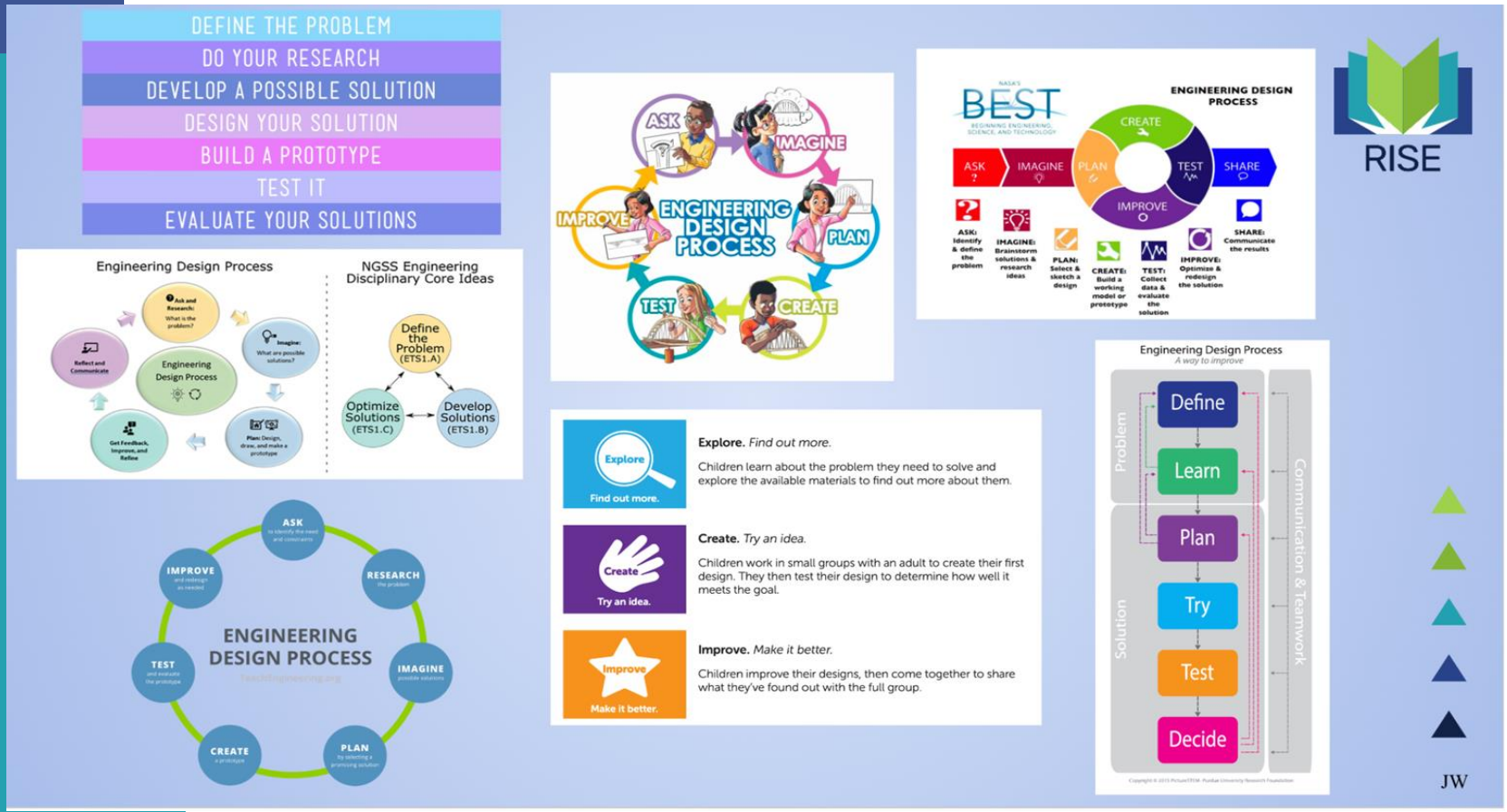
Participant Sample

Leveraged Children's Literature



Images from “Dreaming Up”



Engineering Design Process

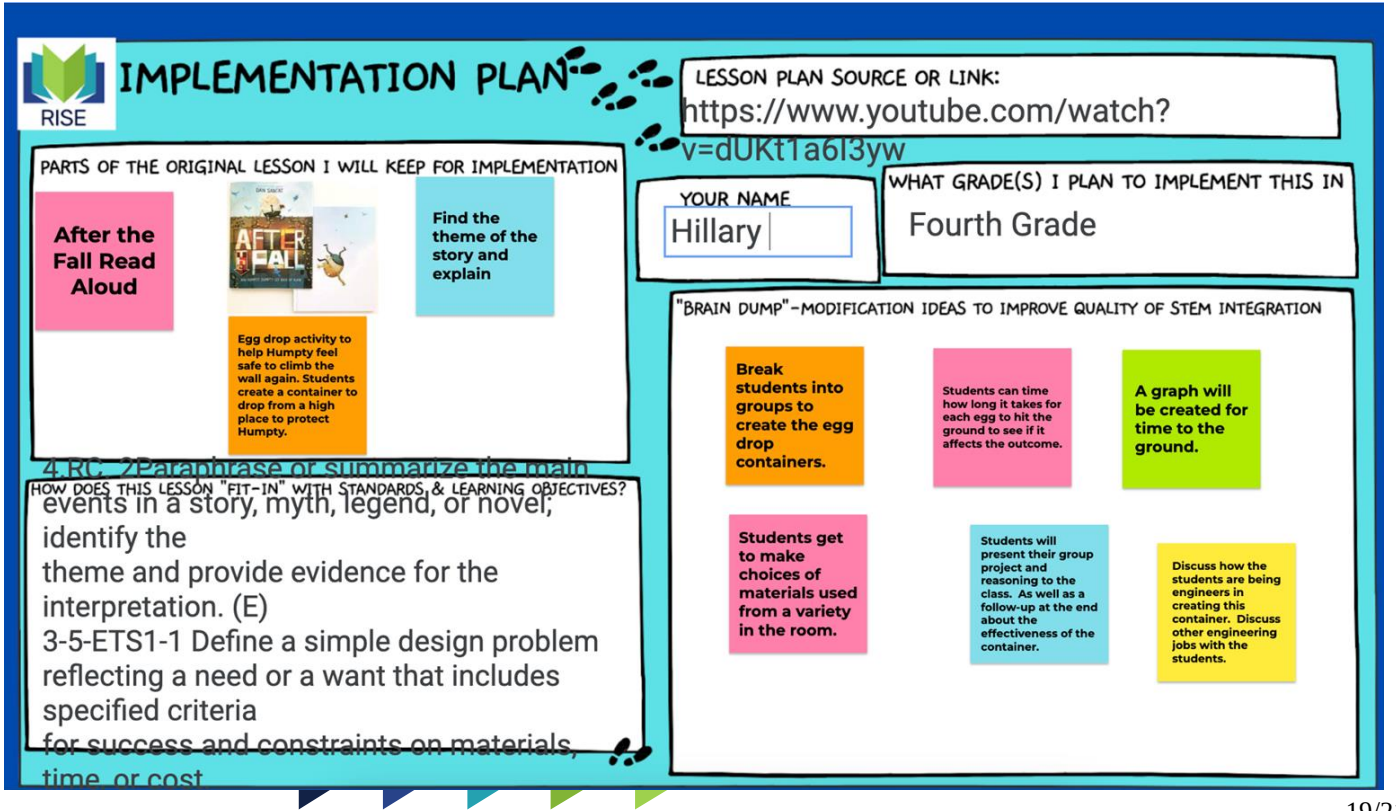
Engineering at home

STEM OP

STEM Observation Protocol (STEM-OP)

1	**Relating Content to Students' Lives**	
	Students' everyday and personal experiences from outside the classroom are activated, meaningfully incorporated into the lesson, and related to the development of STEM knowledge.	• Are the experiences shared by the teacher? By students? • How strong is the connection between the experiences and lesson content?
2	**Contextualizing Student Learning**	
	Learning is contextualized within an appropriate (e.g., age, gender, race, etc.) real-world problem or design challenge that connects to the content of the lesson. Connections between students' learning and the context are explicit so that students understand the importance of their learning.	• Does the teacher state a clear real-world problem or design challenge? • How strong is the connection between learning and context?
3	**Developing Multiple Solutions**	
	The teacher promotes students' development of multiple solutions during the STEM lesson. Students are encouraged to develop multiple design alternatives and evaluate them, identifying the relative advantages and disadvantages of each possible solution.	• Does the teacher encourage divergent ideas for solutions? • Are design ideas evaluated by students? • Are there opportunities for engineering design and/or redesign?
4	**Cognitive Engagement in STEM**	
	Students engage in learning within a STEM lesson at different cognitive levels. While it is appropriate for students to be expected to learn facts and definitions, it is important that students have opportunities to work at higher levels of cognitive engagement such as applying concepts in new situations, and evaluating and analyzing concepts. In other words, students should experience all levels of Bloom's taxonomy when in a STEM classroom.	• What expectations does the teacher have for what learning "looks like"? • What kind of opportunities are there for students to remember, understand, apply, analyze, and/or evaluate?

STEM Lesson Ideas



Summary

- STEM Career focus
  - Children's literature integration
  - Resources shared on Canvas Site
  - Vicarious experiences - classroom video
- Engineering
  - Modeling of integrated STEM lessons with participants
  - Observe STEM lessons with STEM OP debrief
- Lesson plan design and feedback

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SCAN ME

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