

5th Grade Design Challenge: Morning Booster

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METALS

Learners in Context

- Who?** Fifth graders (10-11 years old)
- What?** Students engage in a problem-based learning experience; develop problem-solving capabilities by gaining empathy for a client & inventing something to enhance their morning (Big Idea 7)
- Where?** A charter school in Boston, MA. The professional values of the faculty are: teachers as coaches, student-centered pedagogy, collaboration, experimentation
- When?** Early October, this is the first of several design challenges spread across the school year
- Why?** Twenty-first century skills are critical to projects everywhere from school to the workplace.

K-12 Standards

Next Generation Science Standards

- 3-5 ETS1-1** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost
- 3-5 ETS1-2** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints.

Common Core ELA Standards

- W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Big Ideas

1. Create a supportive ecosystem
2. Create conditions for high student motivation
3. Leverage observation for building a supportive ecosystem
4. Broaden goals to metacognitive skills and dispositions
5. Assess prior knowledge and monitor progress
6. Teachers should be coaches
7. Use question-driven instruction to create
8. Use contrasting cases to identify important details

Learner Profile

Developmental

- More able to see the world from someone else's perspective
- Improved inductive logic skills
- More able to stay focused for longer periods of time when interested
- More independent
- Quicker to process information
- Better metacognitive skills
- Friendships are becoming deeper and more important

Individual Differences

- Prior experiences may color how students see constructive criticism
- High intra-personal intelligence may help to resist self-referential design
- High interpersonal intelligence may help interview and giving feedback

Learning Goals

	Cognitive	Metacognitive
Conceptual	<ul style="list-style-type: none"> • C1 Understand the steps of a design process • C2 Recall and use vocabulary: client, exploratory interview, empathy, journey map, How Can I statement • C3 Recognize and explain how elements of design fit a specific type of person and purpose 	<ul style="list-style-type: none"> • MC1 Monitor understanding of the design process, use a strategy if low: refer to notes or seek help
Procedural	<ul style="list-style-type: none"> • P1 Plan and conduct an exploratory interview • P2 Create journey map of client's morning • P3 Define the opportunity • P4 Brainstorm, evaluate ideas in terms of constraints • P5 Create storyboards • P6 Incorporate feedback to improve ideas 	<ul style="list-style-type: none"> • MP1 Monitor understanding while conducting interview, ask follow-ups • MP2 Reflect on whether interview q's will lead to the information you want • MP3 Reflect on why you made changes to your work
Dispositional	<ul style="list-style-type: none"> • D1 Develop empathy D2 Develop creativity • D3 Become more open to constructive criticism 	<ul style="list-style-type: none"> • MD1 Reflect on design is based on client or self-referential • MD2 Monitor feelings after reading criticism and remember its purpose

Assessments

	Goals
Journal	C1, C2, C3, D1
Homework	C3
Interview Plan rubric	P1, MP1
Journey Map rubric	P2
How Can I	P3
Eval Table rubric	P4
Storyboard rubric	P5
Revising work rubric	P6, MP3, MD1
Observations	MC1, MD2



Who do you think this car is designed for?
 This is for people who don't want to use gas.
 Why do you think this car can be useful?
 It could be useful for saving gas.

Interview Plan Rubric

- Intro, closing
- Open-ended questions
- Neutral questions
- Concise, understandable questions
- Follow-up questions

Journey Map

- Quantity of points
- Variability of points
- Quotes

Evaluation Table

- How much might it cost?
- How long does it take?
- Is it feasible to make with today's technology?

Research: Impact

Research Question

Does the ability of students to pick for who they design influence their motivation?

Hypothesis

Students will be more motivated when they can choose for who they design

Design

Student group	Pre-unit survey	Research intervention round 1 (Morning Booster unit)	Measures of motivation during project	Post-unit survey	Research intervention round 2 (next unit)	Post-unit survey
Class 1	→	Experimental group	→	→	Maintenance	→
Class 2	→	Control group	→	→	Experimental group	→

Tools

- Survey measures students self-efficacy in domain and value of project
- Measures of motivation include: incorporation of feedback, length of journal entries, time spent on project at home

Research: Implementation

Fidelity Check – Teachers

- Is the teacher giving students time to incorporate feedback?
- Does the teacher normalize constructive criticism?
- Is the teacher giving students enough indep. work time?
- Does the teacher monitor progress and intervene?
- Is lecture and feedback clear, concise and relevant?

Fidelity Check – Students

- Review: are students completing their work?
- Ask: what is preventing you from completing your work?
- Observe: is the student distracted?

Instruction

Lesson 1	Lessons 2-4	Lesson 5	Lesson 6	Lesson 7	Lessons 8-9	Lesson 10
Gain awareness	Interview peer	Journey map	How Can I...?	Brainstorm	Evaluate ideas	Present

Diagram of the design process scaffold (Schwartz et al 211-212)

Routines

- Entry: answer a prompt or share homework with a friend. This activates their prior knowledge (Big Idea 5)
- Outbound: journal period, which assesses various goals and builds their metacognitive skills
- Teacher reframes failure and constructive criticism (Big Idea 1)

Contrasting Cases

- What makes each ball suitable for its purpose? (Big Idea 8)

Worked Examples

- Teacher models and thinks aloud.
- Poster gives s's a fixed model (Big Idea 3)

Feedback

- Specific, timely, understandable, nonthreatening
- Students have time to revise work (Big Idea 6)