

Design and Development of Transmedia Narrative-based Curricula to Engage Children in Scientific Thinking and Engineering Design



*Transforming Engineering
Education for Middle Schools*

Context

- Lack of NGSS-aligned engineering curricula for middle school
- Need for students to develop STEM identities, STEM efficacy
- Need for innovative pedagogies to engage students

Hypotheses

- **Hypothesis #1:** Imaginative education presented in a transmedia format increases learners' capacities for both far transfer (innovation) and direct application (efficiency) of engineering concepts.
- **Hypothesis #2:** Imaginative education presented in a transmedia format increases the formation of STEM identity.

Research Design

- Design 2 engineering units, 6 integrated engineering-science lessons for 6th graders
 - Curriculum named “TEEMS”
 - Transmedia, based on theory of Imaginative Education
- Local teachers divided into treatment and non-treatment groups
- Treatment teachers implement TEEMS in science classes
- Survey and learning outcome data collected

Evaluation Plan

- STEM Identity assessment: S-STEM survey and complementary measures for interest, affinity, and engineering identity
- Engineering assessment: PFL authentic assessment tasks (problem-solving, process diagram) and complementary reflection assessment
- Qualitative feedback from educators: focus groups

Evidence-Based Results

- Preparation for Future Learning
- STEM Identity

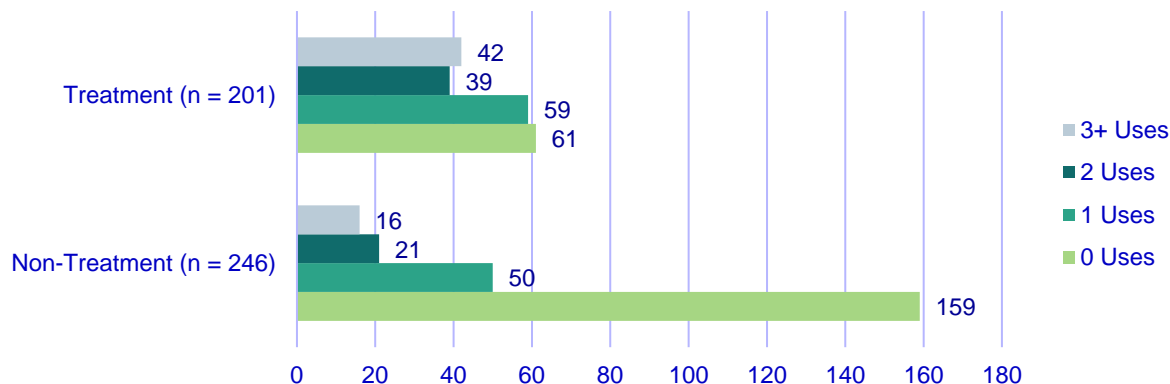
Evidence-Based Results

Preparation for Future Learning

- ❑ Fluency of student responses—students' ability to efficiently use engineering terminology and concepts—differed considerably between treatment and non-treatment groups

Evidence-Based Results

Fluency levels of student responses to the authentic problem-solving task



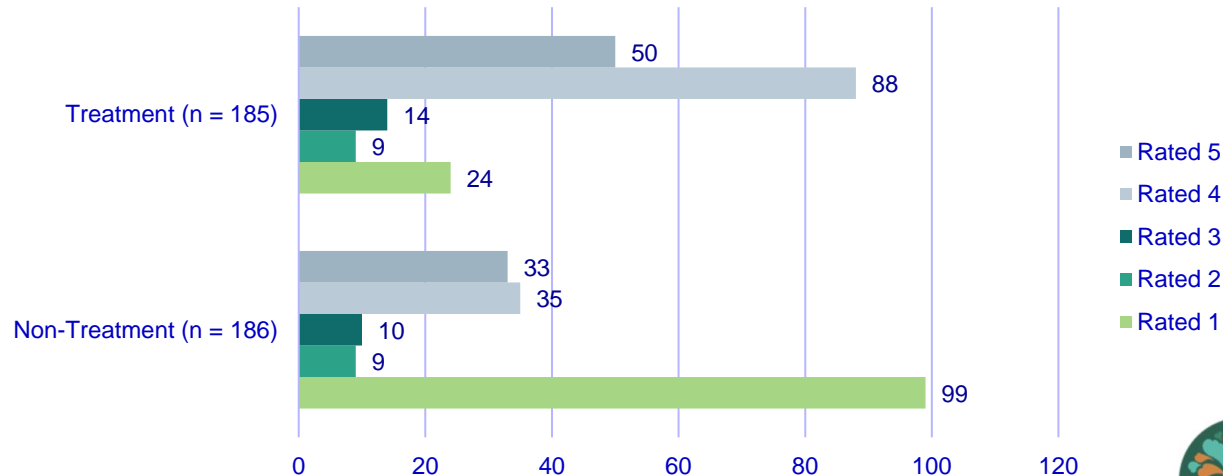
Evidence-Based Results

Preparation for Future Learning

- ❑ Elaboration of student responses—student' ability to create innovative, sophisticated representations of their understanding—differed between treatment and non-treatment groups

Evidence-Based Results

Elaboration ratings of student responses to the conceptual drawing task



Evidence-Based Results

STEM Identity

- ❑ Preliminary evidence of a positive relationship between experiencing the TEEMS curriculum and aspects of students' engineering identity related to concept identification and orientation

Evidence-Based Results

STEM Identity

- ❑ Evidence of a growing interest in engineering after experiencing the curriculum

Evidence-Based Results

Pre-survey and post-survey comparisons of students' interest in engineering

<i>Before this school year...</i>			<i>Now...</i>		
	Freq.	%		Freq.	%
I was very interested in engineering	22	7%	I am very interested in engineering	77	27%
I was a little interested in engineering	86	30%	I am a little interested in engineering	155	53%
I was not interested in engineering	162	56%	I am not interested in engineering	58	20%
I didn't know what engineering was	20	7%			

Products

- 2 transmedia, story-based units, 6 lessons
 - Student website: goteems.com
- Teacher's curriculum guides, handouts, blog
 - Teacher website: teemsproject.com

Implications

- Promise of story-based, transmedia teaching approach
- Evidence supporting the utility of inquiry-based engineering learning in pre-college engineering education

Making an Impact

- Local teachers talk about transforming their own curricula
- Teachers otherwise had to find their own engineering curriculum
 - Engineering is the one topic not included in the district's purchased curriculum

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