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

- **Treatment (n = 201)**
  - 3+ Uses: 42
  - 2 Uses: 39
  - 1 Use: 59
  - 0 Uses: 61

- **Non-Treatment (n = 246)**
  - 3+ Uses: 16
  - 2 Uses: 21
  - 1 Use: 50
  - 0 Uses: 159
Evidence-Based Results

Preparation for Future Learning

- Elaboration of student responses—student’s 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

- Treatment (n = 185)
  - Rated 5: 14
  - Rated 4: 24
  - Rated 3: 33
  - Rated 2: 35
  - Rated 1: 50

- Non-Treatment (n = 186)
  - Rated 5: 9
  - Rated 4: 24
  - Rated 3: 35
  - Rated 2: 10
  - Rated 1: 99
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
STEM Identity

- Evidence of a growing interest in engineering after experiencing the curriculum
Pre-survey and post-survey comparisons of students’ interest in engineering

<table>
<thead>
<tr>
<th>Before this school year...</th>
<th>Now...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq.</td>
</tr>
<tr>
<td>I was very interested in engineering</td>
<td>22</td>
</tr>
<tr>
<td>I was a little interested in engineering</td>
<td>86</td>
</tr>
<tr>
<td>I was not interested in engineering</td>
<td>162</td>
</tr>
<tr>
<td>I didn’t know what engineering was</td>
<td>20</td>
</tr>
</tbody>
</table>
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
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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