

Experiences, Activities, and Personal Characteristics as Predictors of Engagement in STEM-Focused Summer Programs

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Purpose

- To examine perceived challenge, relevance and opportunities to learn as subjective conditions for increased engagement in summer STEM programs for youth
 - To explore whether specific program activities engender subjective conditions tied to youth engagement



The Promise of Out-of-School-Time (OST) Programming in STEM

- Proliferation in recent years
- General positive effects of participation
 - Increased interest in STEM fields
 - Improved work habits & task persistence
 - Increased likelihood of choosing STEM career path

(Dabney et al., 2012; Greene et al., 2013; Kataoka & Vandell, 2013; Mohr-Schroeder et al., 2014)

- Variable quality, structure, and focus on STEM
- How can youth educators facilitate youth engagement in these programs?



Engagement

- “The holy grail of learning” (Sinatra et al., 2015)
- Multidimensional
 - **Behavioral:** effort & participation
 - **Cognitive:** mental investment
 - **Affective:** pos. & neg. feelings toward learning activities
- Dependent on Context
- Critical for achievement, advancement and persistence in a domain

(Christenson et al., 2012; Fredricks et al., 2004)



Conditions for Engagement?

- Perceived Challenge (*Csikszentmihalyi, 1990; Shernoff et al., 2003*)
- Perceived Relevance (*Assor et al., 2002; Koballa & Glynn, 2007*)
- Perceived Affordances for Learning & Skill Development (*Silvia, 2006, 2010*)
- Applicability to informal learning environments?



The Very Practical Question:

- If challenge, relevance or affordances for learning really do facilitate engagement, what kinds of activities in summer STEM programs engender feelings of challenge, relevance and learning?



The Role of Youth Characteristics

- May have direct associations with engagement, challenge, relevance and/or learning
- May moderate associations between activities, challenge, relevance, learning, & engagement
- Perceived Competence
- Gender



Method

- 9 summer STEM programs
- 203 youth ($M_{age}=13$, 87% Black/Hispanic, 50% Female)
- Pre-program Survey
 - *Perceived Competence*: 2 items per domain (Vandell, et al, 2008)
- Video
 - 6 days over 3 weeks
 - Activity categories: basic skills, creating products, STEM expert speaker, lab, program staff led activity, non-STEM



Method (cont'd)

- Experience Sampling Method
 - 4 signals per day for 6 days (2,968 total responses)
 - Concurrent with video
 - *Engagement* (concentration, enjoyment, interest, hard work, $\alpha=.85$)
 - Challenge
 - *Relevance* (impt. to you & future, useful outside program, $\alpha=.84$)
 - *Learning*
- Analytic Strategy
 - 3 level cross classified random effects models

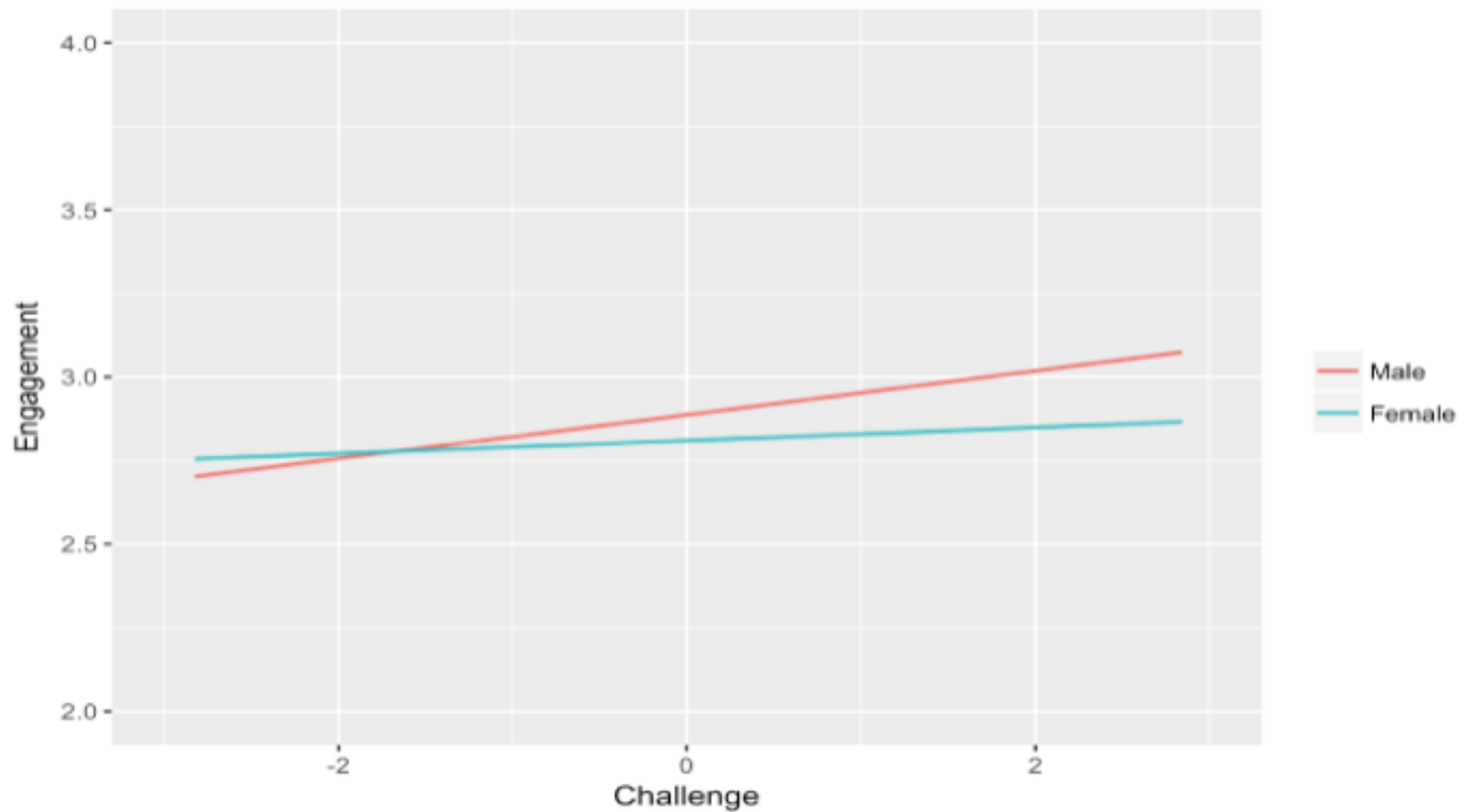


Results: What Predicts Youth's Momentary Engagement?

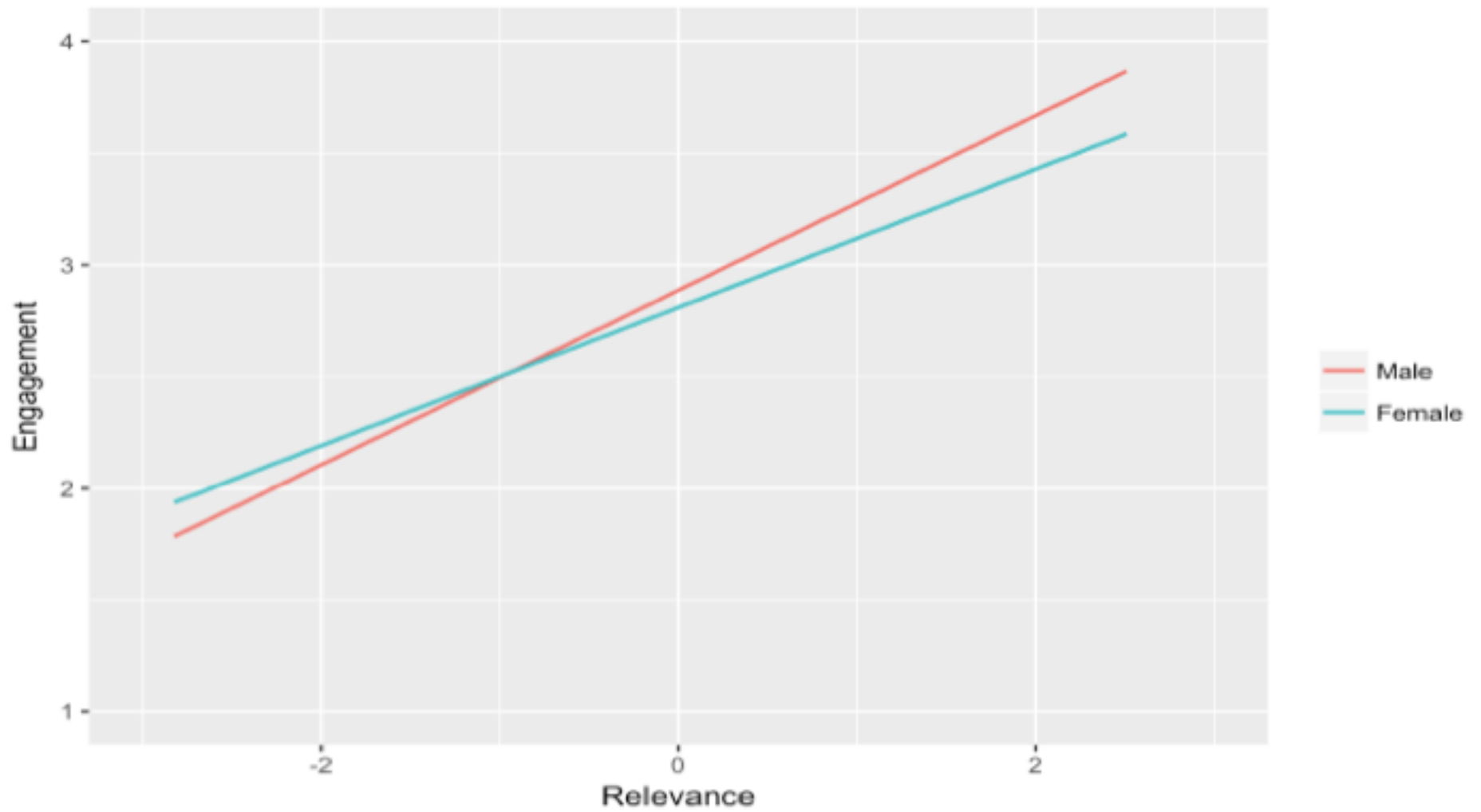
- NOT initial competence
- Challenge
 - For boys ($\beta = .07^{***}$) but not girls ($\beta = -.05^*$)
- Relevance
 - More so for boys ($\beta = .39^{***}$) than girls ($\beta = -.08^*$)
- Learning
 - Equally for boys ($\beta = .27^{**}$) and girls ($\beta = .01$)



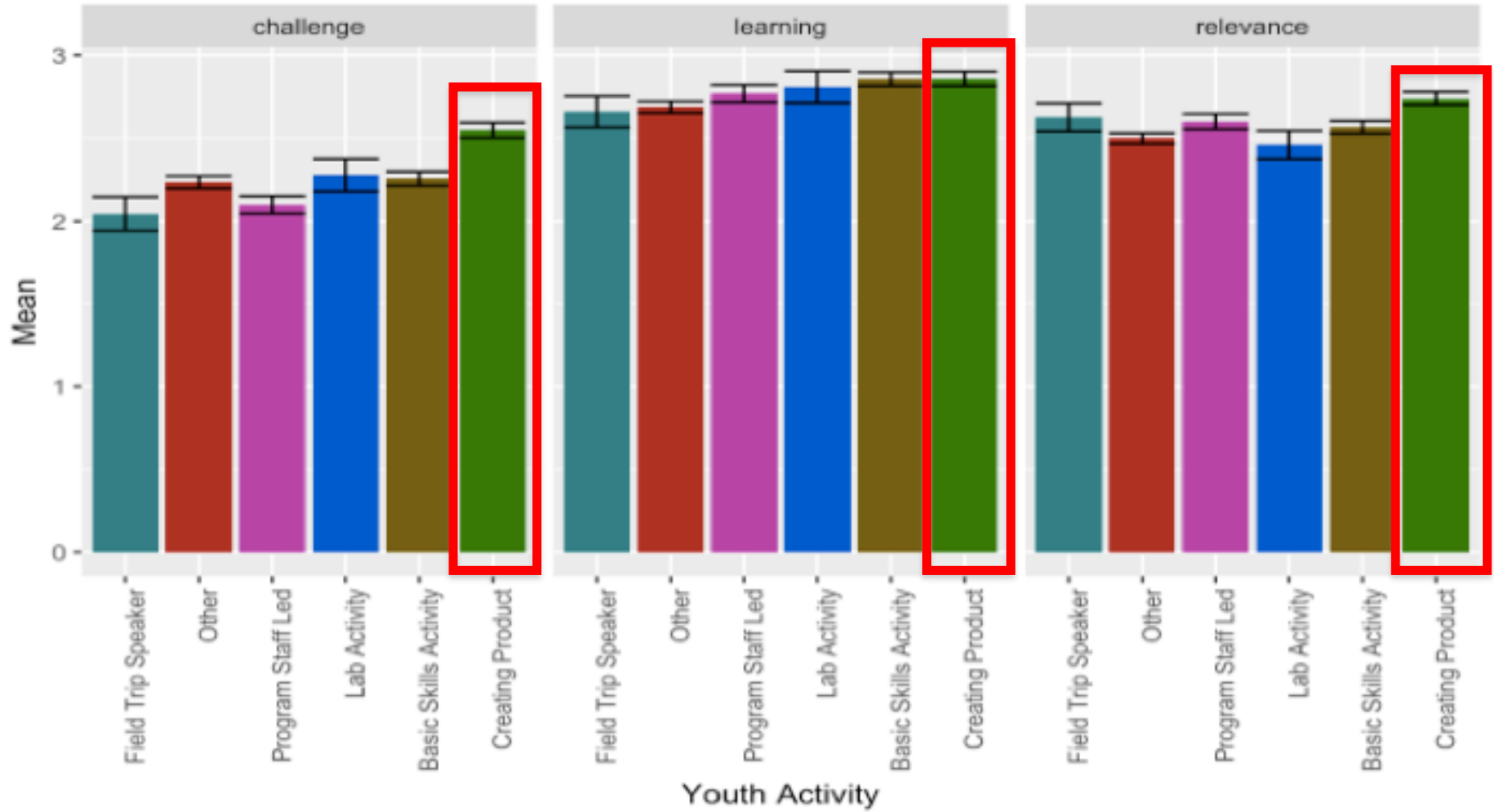
Interaction Between Gender and Challenge on Engagement



Interaction Between Gender and Relevance on Engagement



Means of Outcomes by Youth Activity



Limitations & Considerations

- Unique participant population
- Focus on STEM broadly, not specific disciplines
- Limited characterization of program activities (e.g., lab, creating product, presentation, etc.)
- Little focus at present on observer indicators of quality programming



Discussion and Implications

- Challenge, relevance, learning all independently associated with engagement
- Male & female youth are differently responsive to conditions of challenge, and to a lesser extent, relevance
 - Girls generally perceive lower challenge & relevance
 - Associations with engagement more muted for girls



Discussion, cont'd

- Perceived competence not associated with challenge, relevance, learning or engagement in this context
- Creating product engenders all 3 engagement conditions (and equally for boys & girls)
- Surprising findings re: relevance (basic skills and program staff led)
- Labs generally didn't live up to their promise



Areas for Future Study

- Explaining gender differences in challenge and the association between challenge engagement
- Take a deeper dive into understanding qualities of specific activities that make them challenging or relevant
- How can educators meaningfully assess youth's perceptions of challenge, relevance and learning?



Thank you!

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