Camps, Clubs, and Competitions: Results from a Robotics Project




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Program Description

- Informal education robotics program for youth ages 9 – 14
- Served over 5,000 youth (70% male/30% female) and 400 educators
- Focused on building and programming robots using LEGO Mindstorms NXT platform
- Program formats
  - Camps – week long in summer sponsored by 4H, youth organizations, non-profits
  - Clubs – met during academic year; sponsored by 4H, school, youth organizations
  - Competitions -- FIRST LEGO League

Evaluation/Research Questions

1. What is the impact on youth STEM knowledge, attitudes, and career interests? (pre-post and treatment/control)

2. What are processes underlying STEM learning and career orientation? (path model using SEM)

3. How do youth perceive individual STEM knowledge and skills gained during camps?

   - Did youth view camps as primarily a technology experience?
   - Did youth recognize that science and math were embedded in the curriculum?
   - Did youth believe that what they learned in camp would help them in school?

Question #1: Outcome Variables

- STEM knowledge – multiple choice assessment
- STEM interest --perceived value
  - *I like learning new technologies like robotics.*
- Self-efficacy -- confidence
  - *I am certain I can fix the software program for a robot that does not behave as expected.*
- Problem solving
  - *I make a plan before I start to solve a problem.*
- STEM career interest - scientist, engineer, mathematician, technology specialist

Results

- Knowledge
  - Strong effect sizes for knowledge outcomes driven primarily by engineering and programming scores
  - Low effect sizes for math

Results

- STEM Interest
  - No consistent increases in youth perceived value and importance of STEM subject areas
- Robotics self-efficacy - high effect sizes
- Problem solving – high effect sizes for camps and competitions

Results

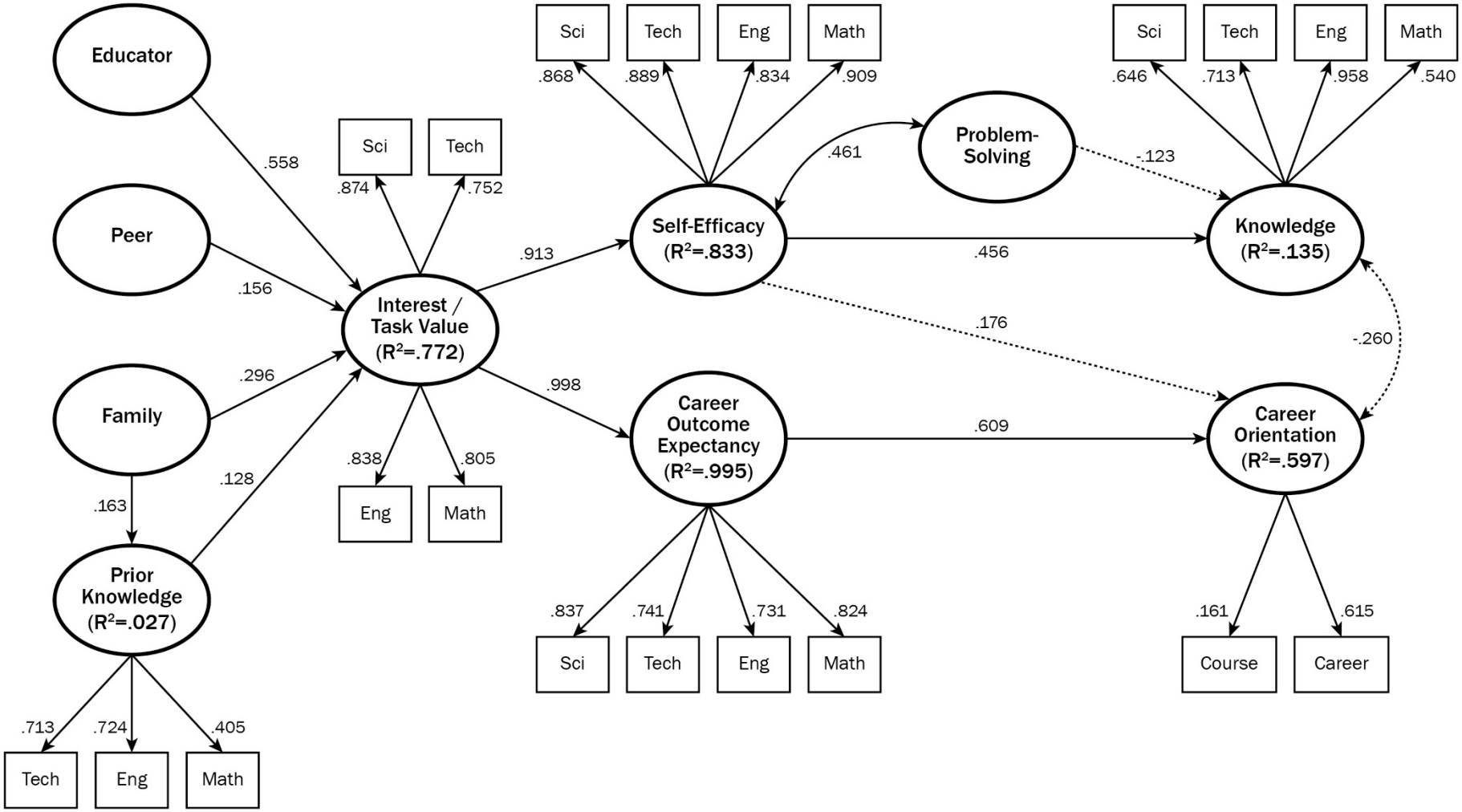
- Career interest
  - Inconsistent results
  - Most potent effect was for engineering

Research Question 2

Processes Underlying STEM Learning and Career Orientation

The Path Model

Results: Path Model

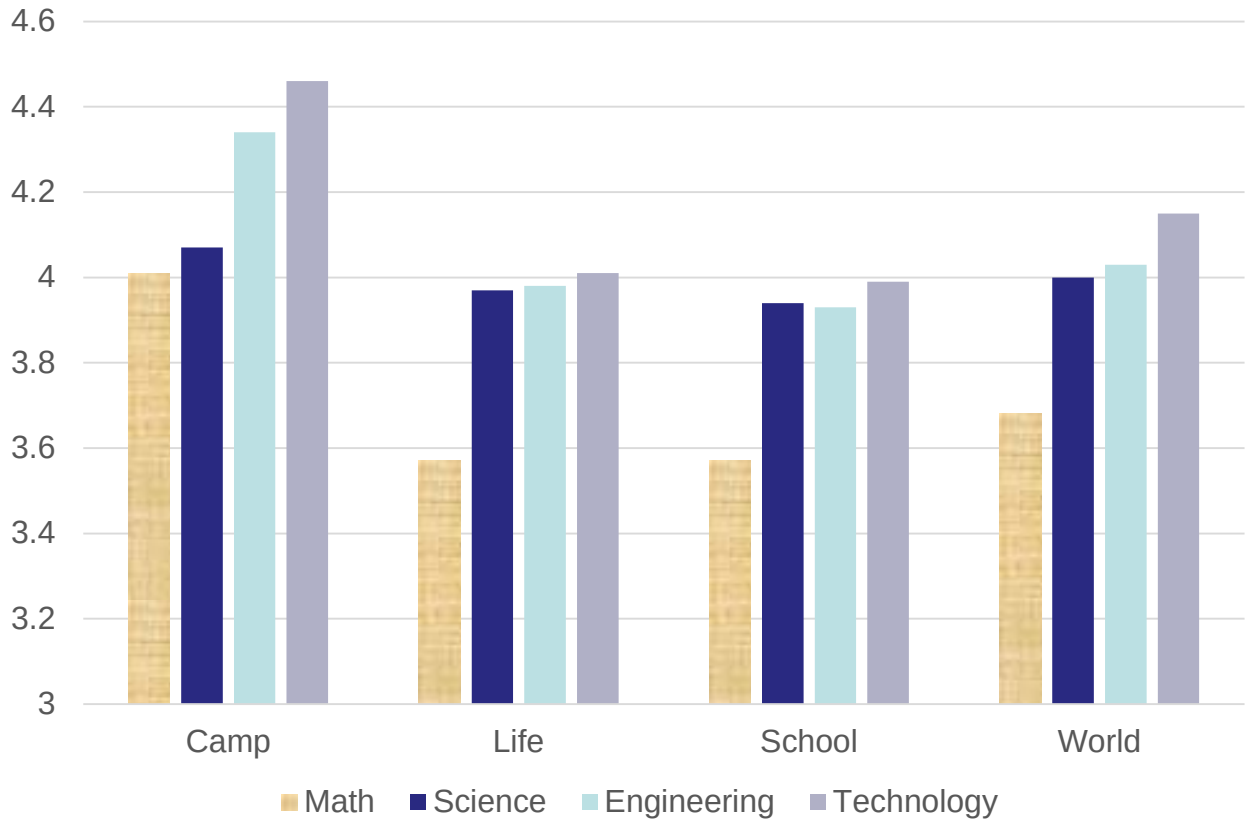


BACKGROUND & CONTEXT | INTEREST | SELF-EFFICACY & EXPECTANCY | LEARNING STRATEGY | OUTCOMES

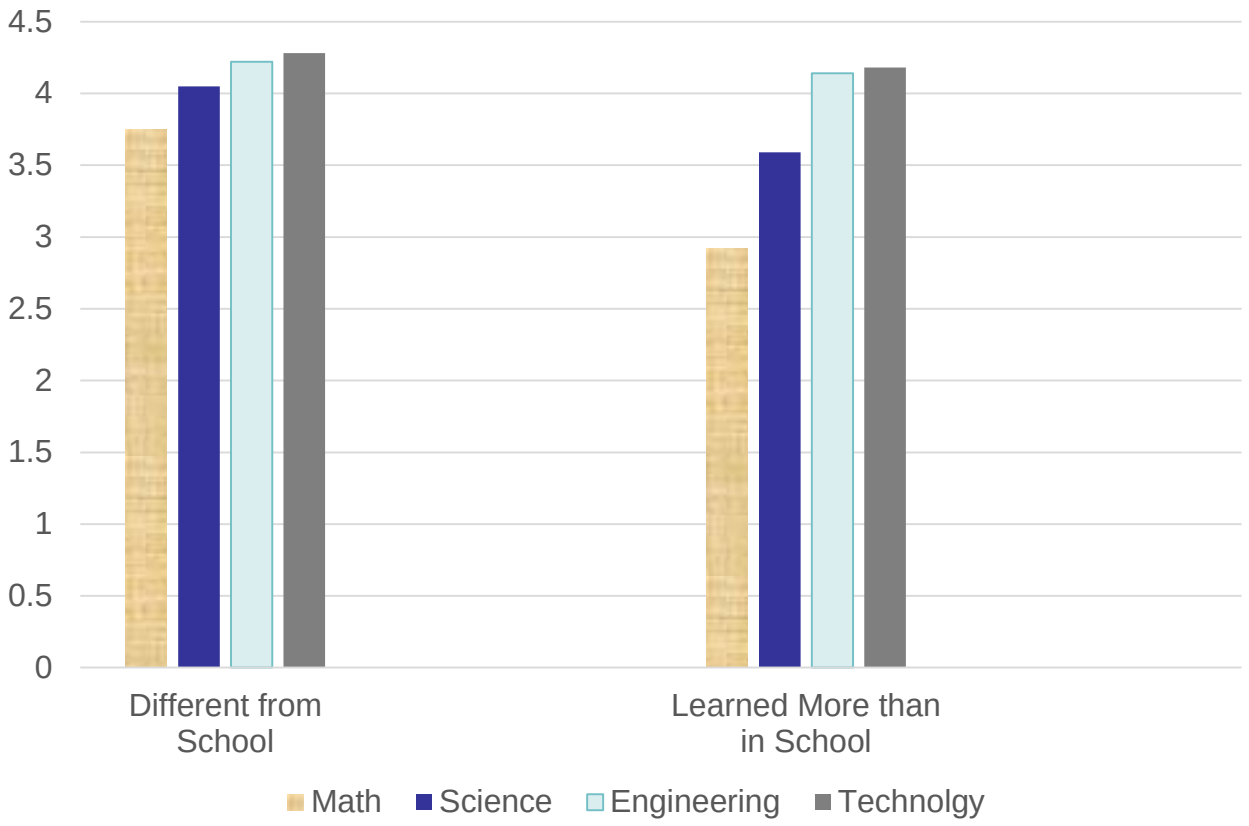
Research Question 3

- Youth perception of STEM content
  - *I had to use _____ to successfully complete the robotics activities in this camp.*
  - *I gained knowledge in this camp that helped me understand the impact of ___ on my life, the world, and in school.*

Student Perceptions of STEM Skills Learned in Robotics Camps



Student Perceptions of STEM Learning from Camps vs. Schools



Summary

Camps, clubs, and competitions supported youth:

- Learning of engineering and programming
- Robotics self-efficacy

Generally did not support:

- Math learning

Summary

- Most potent effects for all outcomes were found for camps
- Youth perceived camps as engineering and technology experiences
- Path model showed value of using strategies that promote youth interest and self-efficacy

Project Website

www.gt21.org