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
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

Different from School

Learned More than in School

Math  Science  Engineering  Technology
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