Impact of Fab Lab Tulsa on Student Perception of Self and Attitude toward STEM

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INTRODUCTION
Science, Technology, Engineering, and Math (STEM), is one of the most widely discussed subjects in the education field today. Proponents of increasing STEM-related content in and out of classrooms are doing so with the more long-term goal of increasing awareness and interest in STEM-related careers among students. Indeed, existing research suggests improving student attitudes toward STEM-related concepts is key to gaining their interest in pursuing those fields. Helping students experience confidence in their ability to be successful with the real-world application of technology and engineering is equally important. The purpose of this presentation is to discuss an outcomes research collaborative intervention effort at Fab Lab Tulsa among school-aged children.

The Hardesity Center for Fab Lab Tulsa serves the Tulsa community by providing access to advanced manufacturing and digital fabrication tools. While Fab Lab Tulsa has the goal of serving the community at large, it also has the goal of bridging the education gap between the classroom and the real world application of STEM concepts.

METHODS
Participants in this study were selected from a variety of local youth organizations and schools, including those that assist with troubled youth. At the conclusion of the survey period, 156 total surveys had been collected. 54% of participants were male, while 46% of respondents were female. Ages ranged from 8-15. In regards to race, the majority of respondents reported being Hispanic (33%), African American (29%) or Caucasian (28%).

Data collection took place at Fab Lab Tulsa and was administered by Fab Lab Tulsa staff. The pre-test was done during the initial orientation and before any activities had begun. The post-test was administered after the completion of all projects. The data collection took place over a 4-week or 12-week period, depending on what project was being completed. Surveys were then de-identified by Fab Lab Tulsa staff and given to the Center of Applied Research for analysis.

MEASURES
Evaluation consisted of a self-report questionnaire completed by the students. The self-report questionnaire consisted of six variables, two of those variables, efficacy and attitude, were measured at the pre-test and post-test.

**Efficacy Scale** (Pir: M = 23.74, SD = 3.30, α = .60; Post: M = 24.24, SD = 3.36, α = .69) was adapted from Melcho, Zhang, Spieres, & Lester (2012) and consisted of six questions using a 5-point Likert format with scores ranging from 1=Strongly disagree to 5=Strongly agree. The goal of measuring efficacy was to determine whether individuals who completed a Fab Lab program felt more confident with technology and engineering.

**Attitude Scale** (Pir: M = 24.21, SD = 3.72, α = .72; Post: M = 24.41, SD = 3.54, α = .71) was adapted from STEM Learning in AfterSchool (2011) and used six questions with a 5-point Likert format with the same range of scores as efficacy. The goal was to determine whether having completed a Fab Lab Tulsa program changed individual attitudes toward technology and engineering.

**Impact Scale** (M = 23.11, SD = 3.55, α = .87) was adapted from Melcho, Cohen, Cutter, & Learvis (2005) and consisted of 7 questions measuring ways in which Fab Lab Tulsa impacted student perceptions of engineering and technology. The scale used a 4-point Likert format ranging from 1=Strongly disagree to 4=Agree.

**Skills Scale** (M = 19.25, SD = 2.91, α = .68) was adapted from Melcho, Cohen, Cutter, & Learvis (2005) and consisted of 6 questions about the skills learned at Fab Lab Tulsa. The scale used a 4-point Likert format with scores ranging from 1=Not at all to 4=At least one.

**Children’s Hope Scale** (Spyker et al., 1997) (M = 26.61, SD = 5.91, α = .83) consisted of 6 questions with two subscales, pathways and agency, and a total score. The scale uses a 6-point Likert format with scores ranging from 1=Don’t believe the time to 6=All of the time.

PEARSON CORRELATIONS

Pearson correlations were run to examine the relationships between efficacy, attitude, impact, skills and hope. Efficacy and attitude showed significant correlations in a number of ways. The pre-efficacy and pre-attitude scales were significantly correlated (r = .62, p < .01), as were the post-efficacy and post-attitude scales (r = .67, p < .01). Change scores were also computed for the efficacy and attitude scales, and the change scores for efficacy and attitude were significantly correlated (r = .30, p < .01).

Thus, as individuals became more confident in their ability with technology and engineering, their attitudes positively changed.

**PRE- AND POST-TEST FINDINGS**

Apaired Samples T-Test was used to assess the change in mean scores from time 1 to time 2 on the efficacy and attitude scales. The pre-mean score for efficacy in the pre-test was 23.68, while the post-test mean was 24.34. This change was found to be statistically significant from pre- to post-test (t[144] = -.55, p < .05). The attitude mean scores for pre- and post-test were 24.12 and 24.38, however, scores on the attitude scale were not found to be statistically significant (t[145] = -.26, p > .05) despite the mean score improvement. A Repeated Measures ANOVA was also run to determine whether the change was dependent on gender, but gender was found not to be a significant factor.

**REFERENCES**


