Demographic Differences Between Museum-Based Fab Lab Attendees and Non-Attendees

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Background

The Maker Movement has grown rapidly. Among its impacts has been an increase in public access to high-end manufacturing equipment and influence in a variety of fields including the manufacturing industry, education, public policy, and citizen science. Fab Labs, a particular type of makerspace focused on digital fabrication and production, are most common in informal learning environments such as libraries, but have begun to be installed in schools and universities. Opened in 2007, Wanger Family Fab Lab (hereafter Fab Lab) offers a variety of programs including public-facing workshops about 3-D printing, vinyl cutting, and laser cutting at the Museum of Science and Industry, Chicago and longer duration programs that occur both in-school and after-school. Despite the broad appeal of fab labs and makerspaces, there is a lack of documented research on who uses these spaces.

Method and Measures

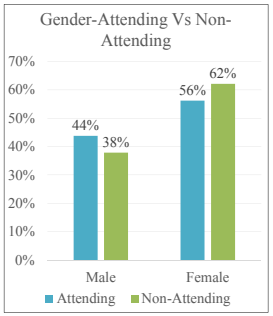
This study surveyed guests who attended and did not attend Fab Lab workshops to see if there were differences in their engineering attitudes, do-it-yourself (DIY) backgrounds, creative identities, or demographics.

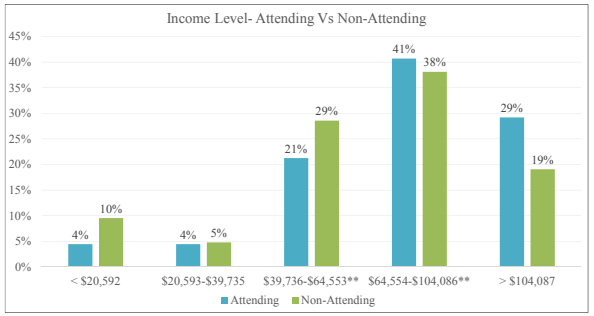
The non-attending group was randomly selected from guests, ages 10 and above, on the Museum floor and the attending group was selected from guests who arrived at the Fab Lab between 7-15 minutes before a workshop began. The attending children had a shorter version of the survey than non-attending children, in order to allow them an opportunity to complete the survey before the workshop.

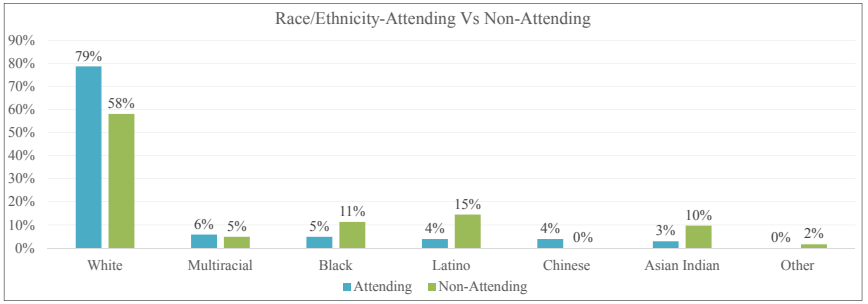
- To measure engineering attitudes, we adopted a modified version of the Engineering Interests and Attitudes (EIA) instrument developed as part of the Engineering is Elementary project at the Boston Museum of Science (Lachapelle, Hertel, San Antonio-Tunis & Cunningham, 2014). The EIA consists of 30 items (reported $\alpha = .91$) grouped into seven subscales. We reduced the instrument to 15 items, taken from across the seven subscales. Items were chosen for inclusion or rejection based on how linked they were to the Fab Lab experience and to remove any recurring items on the scale. The final reliability of our survey was $\alpha = .78$.
- To measure experience with DIY activities, we created a survey measuring guests' background with making, tinkering, and building. The DIY background survey is a checklist of eight items drawn from the National Assessment of Educational Progress (2014) and the Biographical Inventory of Creative Behaviors (Batey, 2007) combined with additional items created by the research team.
- To measure creativity identity, we adopted the Revised Creativity Domain Questionnaire (CDQ-R), which was designed to study self-perceptions of creativity (Kaufman et al., 2010)

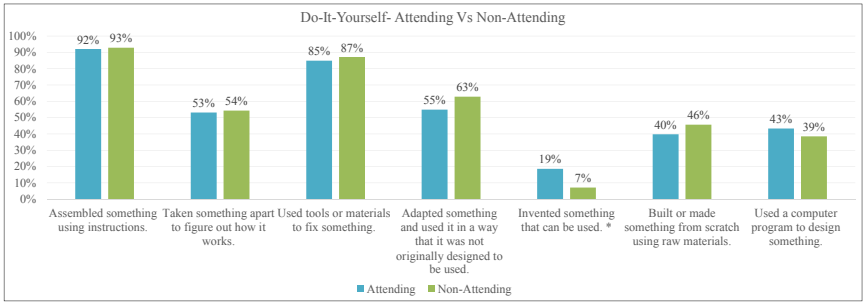
Study Participants		
Attending = 113	Adults= 74	Mean Age= 39.3
	Children=39	Mean Age= 12.9
Non-Attending = 70	Adults= 53	Mean Age= 42.1
	Children= 17	Mean Age= 11.8

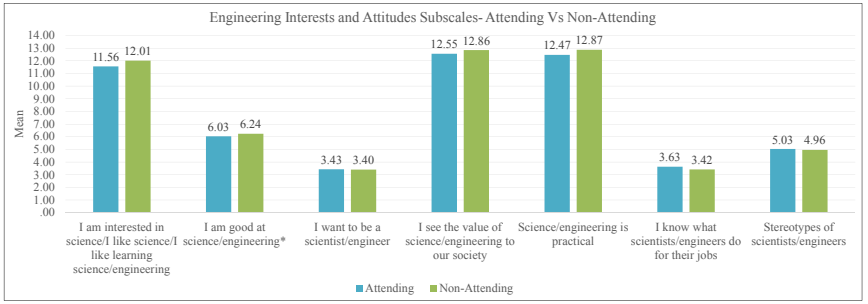
Data











* Statistical Significance p=.03
** Statistical Significance p < .01

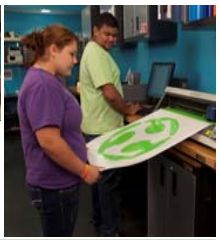
Results

- There were no large differences between guests who attended the Fab Lab and those who did not in terms of **gender**, **education**, **race/ethnicity**, **creative background**, **do-it-yourself background** and **attitudes towards engineering**. Some exceptions include:
  - Attending males reported higher agreement in the EIA subscale "I am good at science and engineering" than non-attending men, $t(58) = .932$, $p < .05$.
  - There was a significant difference on the DIY item "Invented something that can be used," X^2 (1, N = 179) = 5.05, p =.03.
- Income, as reported by the adults, was sorted into quintiles based on the Congressional report *The Distribution of Household Income and Middle Class* (Elwell, 2014). A *t*-test analysis found a significant difference between the means among the attending and non-attending groups $t(111) = -2.72$, $p < .01$. The attending group had a mean income in the 4th quintile ($64,554-$104,089) while the non-attending group had a mean income in the 3rd quintile ($39,736-$64,553).

Discussion

The results show that there were very few statistically significant differences between the attending and the non-attending groups except in an EIA subscale, one DIY item, and mean income levels. Visually there seems to be a difference in the race/ethnicity category; however, the results from a previous study with a higher sample size but a similar recruitment strategy suggest that the percentage of White non-attending participants should be higher and the non-White categories should be lower. So, this visual difference in race/ethnicity could be attributed to the distinct sample sizes in each group or there could have been an error in data collection for the non-attending group. **Overall, results show that a fab lab located in an informal science education setting will draw a representative audience from that setting in terms of demographics, interest in engineering, creative self-efficacy and background in DIY projects.**

Fab labs and similar education-focused maker spaces could be used to engage broad audiences in engineering and do not need to be seen as niche tools. For informal science institutions, fab labs may be well aligned with their current audiences, making them ideal programming options for hands-on science and inquiry. Potential next steps in research include comparisons with non-museum demographics, looking at differences between the various types of programming within a fab lab and studies into what kinds of learning occur in fab labs and maker spaces.



Select References

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