

# How language and parental educational achievement impacts computer science self-



## perceptions in 4th - 12th grade students

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### Curated Pathways to Innovation

- Curated Pathways to Innovation (CPI) is a web-based app that guides and motivates students as they select activities which engage them in the possibility of pursuing a STEM+C career. The app is specifically designed to set women and underrepresented minorities on a path towards STEM careers.
- This research aims to help better engage students into computer science activities by looking at demographic features as an indicator for children's computer science self-perceptions and ability

### Research Question

Are there main or interaction effects on children's self-perceptions in computer science prior to beginning the CPI program based on their parental educational achievement and native language spoken at home?

### Sample

- California public school students were surveyed (N=393) prior to participation in the CPI program. Computer science self-perception indicators were measured along with sample demographic information.
- The independent demographic variables chosen for this study were maternal educational attainment (no college: 53%; at least some college: 47%) and native language spoken at home (English: 55%, Spanish: 35%, Other: 10%).

| Variable                   | N   | Mean | SD  | Reliability |
|----------------------------|-----|------|-----|-------------|
| pre_comp_att_career        | 395 | 3.5  | 1.2 | 0.90        |
| pre_comp_att_work_enjoy    | 392 | 3.4  | 1.1 | 0.90        |
| pre_comp_successful_career | 393 | 3.2  | 1.2 | 0.91        |
| pre_comp_program_future    | 394 | 3.0  | 1.3 | 0.90        |
| pre_comp_att_op_learn_A    | 394 | 3.1  | 1.2 | 0.91        |
| pre_use_comp_get_better    | 392 | 3.5  | 1.1 | 0.91        |

TABLE 1

### Response option

Likert scale 1 = "Strongly Disagree" 2 = "Disagree", 3 = "Neither Agree nor Disagree", 4 = "Agree" and 5 = "Strongly Agree"

### Methods

#### Measures

##### Primary Language spoken

- Question**  
"What is the first language you learned to speak Please type in your answer"
- Response option**  
Written response
- Response Code**  
English (1), Spanish (2) Other (3)

##### Parental Educational Achievement

- Question**  
"What is the highest level of education attained by your mother female guardian"
- Response Option**  
Maternal college education  
"Less than high school", "Some high school", and "High school diploma", "Some college/university", "Associates Degree (2 years)", "Bachelors Degree (4 years)", "Master Degree", "Doctorate/PhD/MD/etc"
- Response Code**  
"Less than high school", "Some high school", and "High school diploma" coded = no college education  
Responses "Some college/university", "Associate's degree (2 years)", "Bachelor's degree (4 years)", "Master's degree", and "Doctorate/PhD/MD/etc." coded = having college education

##### Self-perceptions of Computer Programming Ability

- Question**  
Scale (alpha = 0.92) with seven questions, including the following: ", "I am good at working with computers" "I believe I could have a successful career in computer programming" "I can imagine myself having a career in computer programming" "I enjoy working with computers" "I plan to take a computer programming class in the future" "I wish I had more opportunities to learn how to program computers" "It is important for me to get better at working with computers"
- Response option**  
Likert scale  
1 = "Strongly Disagree" 2 = "Disagree", 3 = "Neither Agree nor Disagree", 4 = "Agree" and 5 = "Strongly Agree"

### Analysis

- One variable t-test to help determine significance of all variables
- Exploratory factor analysis on the self perception measure to determine the number of factors that fit the model
- A 2-way analysis of variance test (ANOVA) determined the variance of each factor to establish independence and provide evidence of a different mean between the groups.
- Reliability was measured by calculating the Cronbach's alpha to indicate internal consistency and item relation in the self-perceptions scale
- Main and interaction effect helped determine how parental education and language impact computer science self-perceptions
- A Tukey posthoc test was conducted to view the significance of each measure

### Results

#### Model Fit

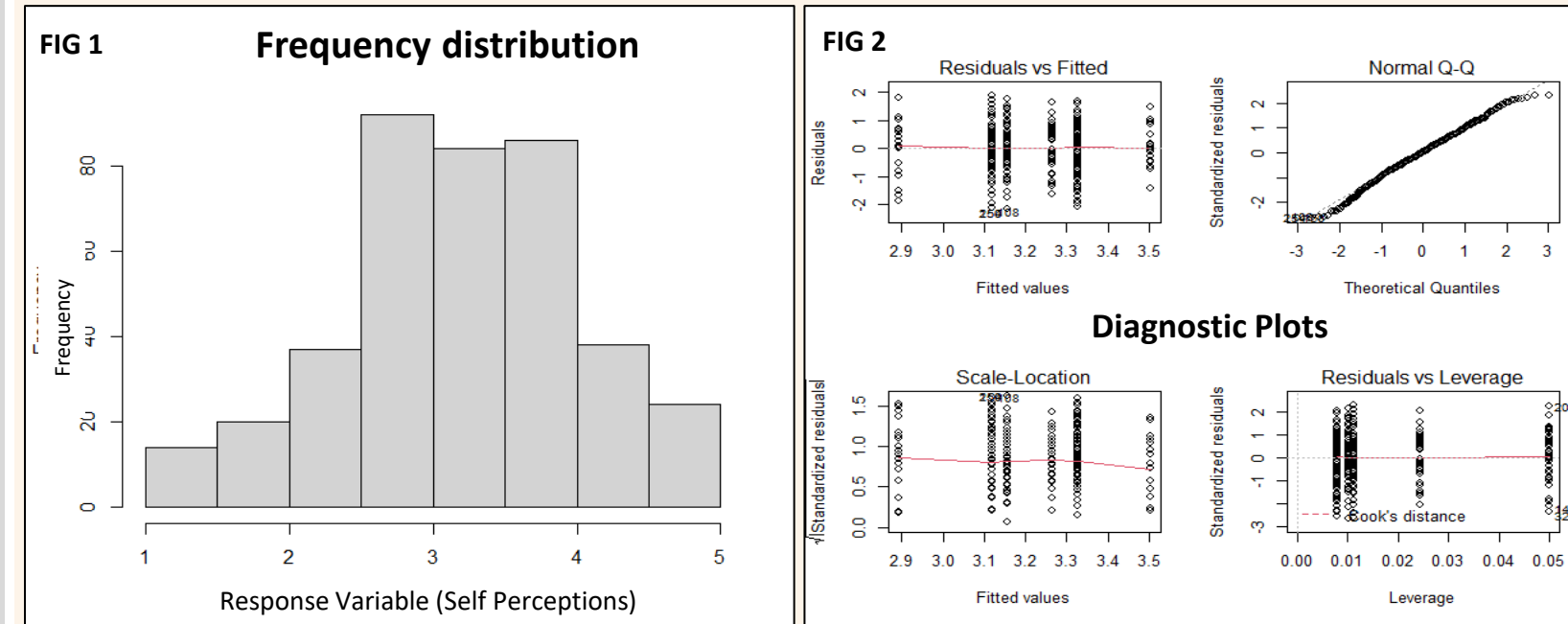


Figure 1 and 2 describe the data to determine if there is unexplained variance or outliers. They determine that there is limited biases in the models

#### 2-way ANOVA Test

TABLE 2

| Response: Self-Perceptions          | DF (degrees of freedom) | Sum Sq | Mean Sq | F-value | Pr(>F)  |
|-------------------------------------|-------------------------|--------|---------|---------|---------|
| Native Language                     | 2                       | 0.242  | 0.1208  | 0.17161 | 0.83864 |
| Parental education                  | 1                       | 4.419  | 4.4187  | 6.4383  | 0.01156 |
| Native Language: Parental education | 2                       | 1.916  | 0.9580  | 1.3958  | 0.24886 |

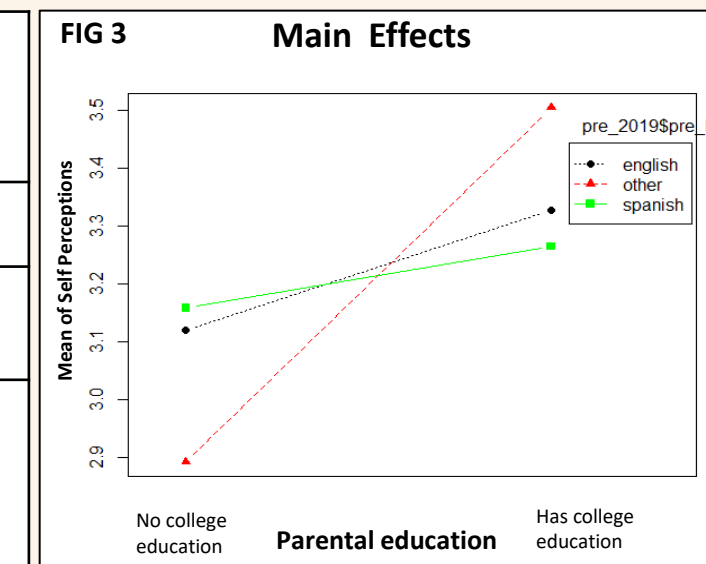


Table 2 describes the analysis of variance results on the computer science self-perception scale. Only parental educational achievement had a significant effect. Figure 3 illustrates the interaction effect between parental education, native language spoken, and self-perceptions. The results suggest there is a main effect of parental education on student's self-perceptions

#### Tukey PostHoc Test

- A Tukey posthoc test was conducted to view significance at a 95% family-wise confidence level
- Students of parents with a higher level of education tended to have better self-perceptions of their computer programming abilities (t = 18.96 p < .05).

### Conclusions

- Statistical analysis revealed a significant main effect for parental educational attainment on students' self-perceptions of their computer programming abilities.
- There was no main effect of native language, nor was there an interaction effect of the two predictors.
- These findings suggest that even before starting the CPI, students already have different perceptions of their computer programming ability, and these perceptions are related to their parents' educational attainment.

### Acknowledgments and References

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<https://www.crc.uiowa.edu/curated-pathways-to-innovation/>

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