

# Motivational Differences to Learn Computer Science Among Middle School Boys and Girls

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## Abstract

In a recent pilot study, we investigated computer science (CS) motivation among middle school students through multiple lenses: identity, interest, value, communal/agentive goal affordances and endorsements, sense of belonging, self-efficacy, and intentions to pursue CS. Our research question was: *What are the motivational differences to learn computer science among boys and girls in middle school?* We collected data from three U.S. sites (California, Michigan, and Illinois) in Spring 2025. We conducted an independent-samples t-tests to ascertain gender differences in each type of CS motivation. While significant results were found across three measures (value for CS, communal goal endorsements, and intentions to pursue CS), the remaining measures did not produce significant differences, indicating that boys and girls may have similar CS identities, interest in CS, sense of belonging in CS, and self-efficacy.

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## 1 Introduction and Background

Prior education research has shown that participation in CS education is partly influenced by students' stereotypes of and who "belongs" in CS [11]. Further, research has shown that, among middle school students from minoritized backgrounds, socially divergent views of computer scientists (e.g., nerdy, male, not athletic) negatively predicts intentions to pursue a CS career, even after accounting for interest in CS and grades in math and science [7].

Additionally, most support for access and participation in computer science (CS) education has occurred at the post-secondary levels, yet studies increasingly show the critical importance of early intervention to meaningfully impact and broaden the talent pathways. While access and participation are critical, a crucial gap remains in understanding how early and repeated experiences in CS education might relate to interest in, learning from, and pursuit of CS education and careers. Further, the CS education community has scant evidence to identify the potential factors that may

buffer underrepresented students from attriting away from CS. Such understanding could prove critical for students, educators, communities, policy makers, and invested organizations interested in promoting access to and participation in K-12 CS education.

Although prior research has identified some differences in motivational beliefs between girls and boys within a CS context [12], a more comprehensive view of motivation is still needed. This is partly because *motivation* has been modeled in numerous prominent ways [13]. For this reason, we sought to answer one primary research question: *What are the motivational differences to learn computer science among boys and girls in middle school?*

## 2 Methodology

Study materials were approved by an Institutional Review Board (IRB). At two sites, caregivers provided signed consent; at the third, caregivers could opt their child out of the study. All participants provided assent when data was collected in early Spring 2025.

Participants may not have had prior CS experiences and were enrolled in middle school (6th–8th grade) across three U.S. school districts (California, Michigan, Illinois). The sample was relatively diverse in gender and race/ethnicity, though boys and Hispanic students were overrepresented when compared to U.S. populations of 6th grade students. Participants were entered into a raffle for one of 100 \$25 gift cards. Schools also received implementation support (up to \$4,500) for study support.

Participants received a survey focused on motivation measures ( $n = 114$ ) and intentions to pursue CS ( $n = 244$ ). Instruments were adapted from previous instruments with evidence of reliability and validity and covered each of the following: identity [10], interest [10], value [1], communal/agentive goal affordances [3], communal/agentive goal endorsements [3], sense of belonging [2], self-efficacy [9], and intentions to pursue [8]. All of the instruments are available at <https://proactcs.org>.

Participants self-identified their gender in a text box, and all identified as either boy or girl. We conducted independent-samples *t*-tests to assess mean differences between the groups for each variable. Three students were excluded due to missing data on the motivation measures. Evidence of reliability and validity for each measure comes from Cronbach's alpha (Table 1), confirmatory factor analysis, and measurement invariance (strict invariance achieved for all except Sense of Belonging).

## 3 Results

Middle school boys and girls in the study differed significantly on three of the scales as shown in Table 1. Specifically, boys valued CS much more than girls and boys also had greater intentions to pursue



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**Table 1: Comparison of means between girls and boys across CS-related constructs. All of the motivation variable tests had  $n = 114$  participants ( $n_{girls} = 52, n_{boys} = 62$ ), and the intentions to pursue CS construct had  $n = 244$  ( $n_{girls} = 108, n_{boys} = 136$ ). Statistically significant differences ( $p < .05$ ) are shown in bold.**

	Girls Mean (SD)	Boys Mean (SD)	Mean Difference ( $p$ )	Cronbach's $\alpha$
CS Identity	2.70 (1.31)	2.88 (1.41)	-0.18 ( $p = .480$ )	.93
Interest in CS	2.44 (1.50)	2.84 (1.60)	-0.40 ( $p = .176$ )	.91
<b>Value for CS</b>	<b>2.83 (1.35)</b>	<b>3.48 (1.59)</b>	<b>-0.65 (<math>p = .020</math>)</b>	.96
CS Communal Goal Affordances	3.87 (0.75)	4.03 (0.78)	-0.16 ( $p = .259$ )	.83
CS Agentic Goal Affordances	3.20 (1.19)	3.39 (1.18)	-0.19 ( $p = .396$ )	.90
<b>CS Communal Goal Endorsements</b>	<b>4.58 (1.77)</b>	<b>3.93 (1.47)</b>	<b>+0.65 (<math>p = .038</math>)</b>	.85
CS Agentic Goal Endorsements	4.30 (1.45)	4.38 (1.32)	-0.08 ( $p = .763$ )	.86
Sense of Belonging in CS	3.60 (1.41)	3.91 (1.47)	-0.31 ( $p = .246$ )	.91
Self-efficacy for CS	3.78 (1.67)	4.01 (1.69)	-0.23 ( $p = .462$ )	.95
<b>Intentions to Pursue CS</b>	<b>2.92 (1.10)</b>	<b>3.27 (1.43)</b>	<b>-0.35 (<math>p = .026</math>)</b>	.83

CS than girls. While this is not surprising given past research, it is also important to know that pedagogical practices can be leveraged to increase girls' value for computing [5, 14].

As with prior research [6], girls rated their endorsements of communal goals (i.e., extent to which they value personal goals like helping people) significantly higher than boys. Counter to hypotheses about the interplay between communal goals and interest [6], girls' and boys' interest in CS was not significantly different.

Interestingly, many of the results across the scales were not statistically significant. Notably, Denner notes that interest in CS is correlated with value for CS. Thus, we might expect both these variables to significantly differ by gender, but this was not the case. Stereotypes have also been known to influence interest in CS [7], which leads us to consider if some of the stereotypes may be changing (generally) among middle schools girls.

#### 4 Limitations and Future Work

Despite the overall positive psychometric properties of our motivation measures, the sense of belonging scale did function similarly between girls and boys (invariance analyses not reported here). Thus, findings regarding this variable must be interpreted cautiously. Further, we analyzed these motivation variables individually—future research could examine them wholistically using person-centered analyses such as latent profile analysis to better determine their potentially complex interplay.

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