Confidence disparities: Pre-course coding confidence predicts greater statistics intentions and perceived achievement in a project-based introductory statistics course

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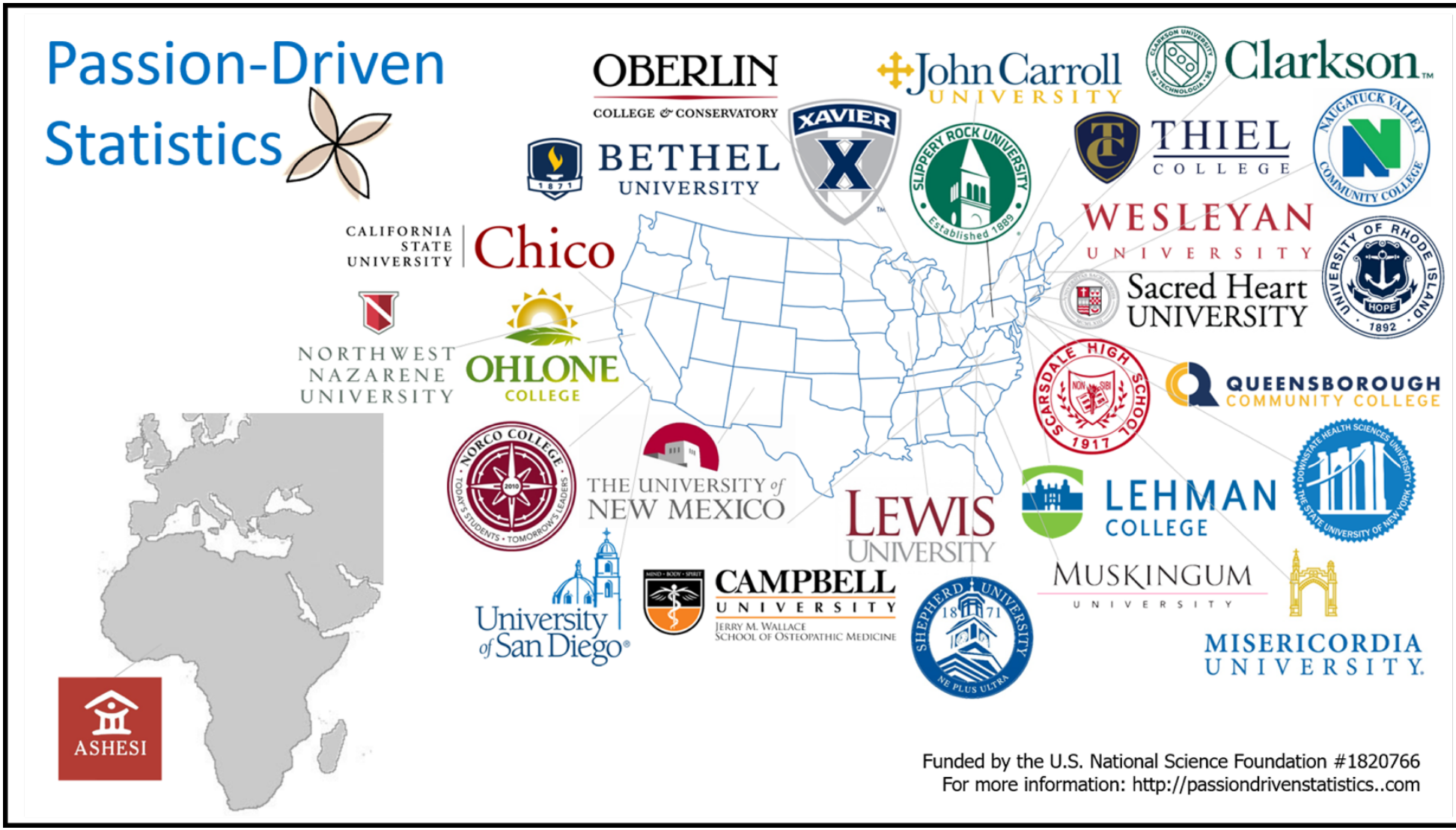
Background

Past research finds project-based statistics can attract minoritized students and increase interest in taking further statistics coursework, relative to standard intro statistics.

Project-based statistics: All students complete a semester-long individual research project using the analysis of real data using a statistical package: Stata, R, SAS, SPSS, StatCrunch

An original research project is a performance accomplishment, so a project-based course can potentially improve students' self-efficacy.

This study evaluates whether pre-course self-efficacy predicts success of a project-based course: motivation to take further quantitative courses and perceived achievement.



US: 11 private liberal arts colleges, 3 flagship state universities, 12 regional city or state universities, and 2 community colleges.
Ghana: 1 non-profit private university.

Methods

We use pre-course and post-course data from a project-based introductory statistics course.

We formulated our mixed-effects varying intercepts model in the data from Fall 2018-Summer 2019 (n=291) and tested the model in Fall 2019-Winter 2020 data (n=624, 21 groups).

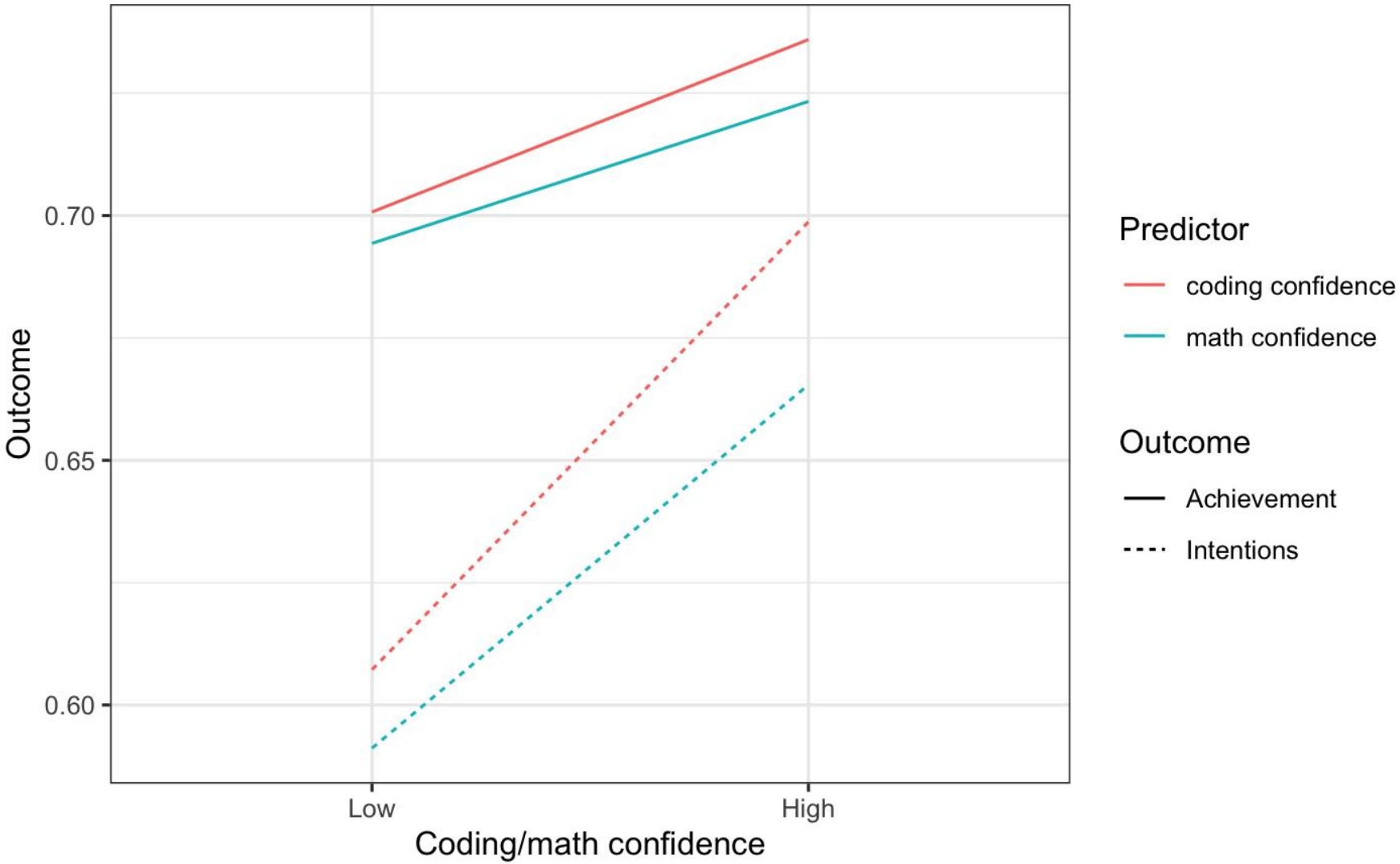
Missing data was due to item non-response, so we used multiple imputation with 20 imputations in a multivariate normal model.

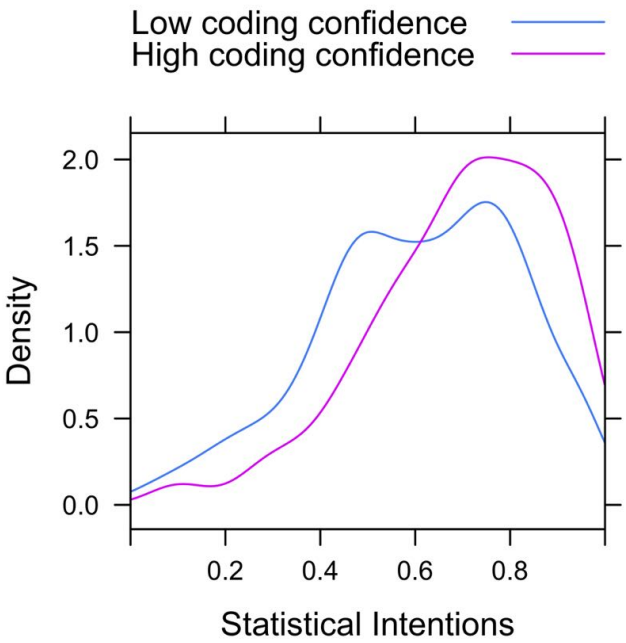
Materials such as electronic textbook with professionally-produced videos for each software package available at `http://passiondrivenstatistics.com/`

Pre-course: 45% reported high math confidence and 19% reported high coding confidence

	Confidence	
	Coding	Math
Male	+	+
Age$>$ 22 y	+	
Hispanic	+	
Coding experience	+	+
High school/AP statistics	+	+
Past college statistics	+	
Course uses R	+	+
Course uses SPSS	-	-
Flagship university	+	
Community college		-
Ghana university		+

Confidence associated with outcomes




Low coding confidence
High coding confidence
Density
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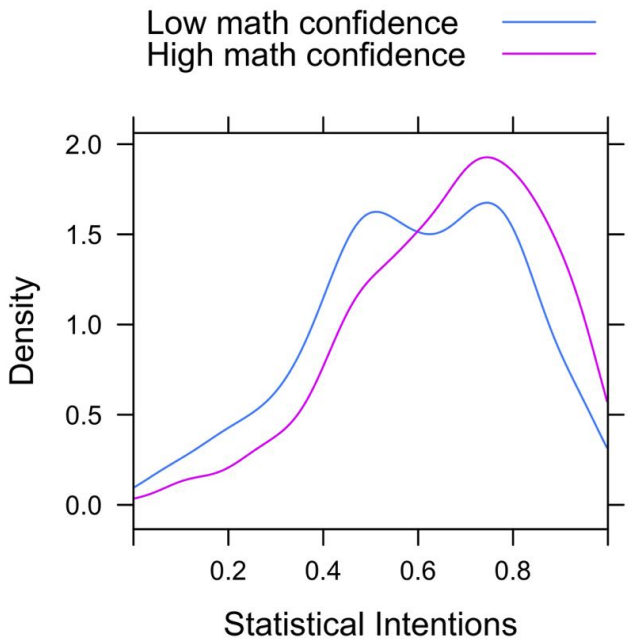
1.0
0.5
0.0
0.2
0.4
0.6
0.8
Statistical Intentions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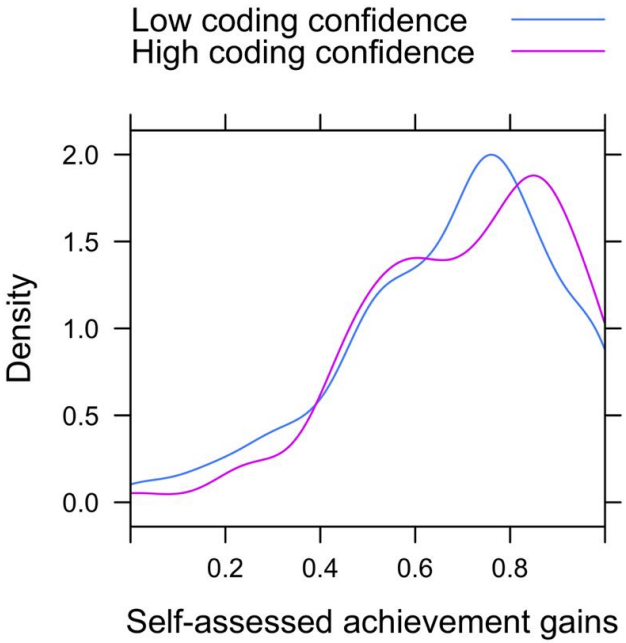
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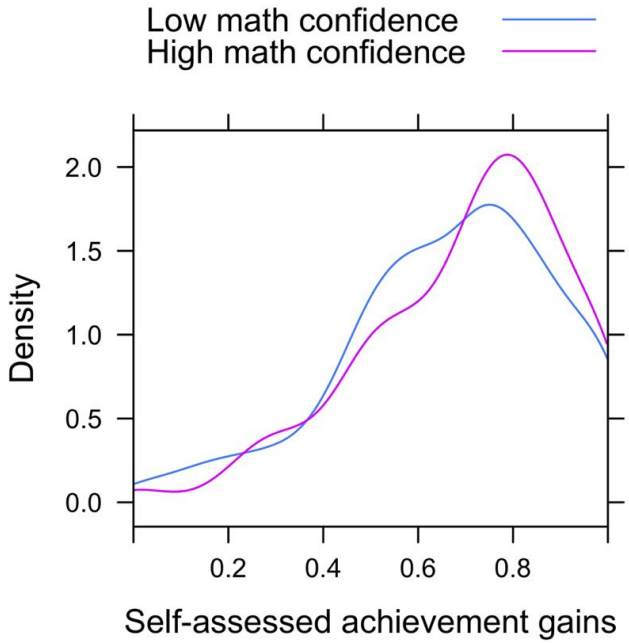
Self-assessed achievement gains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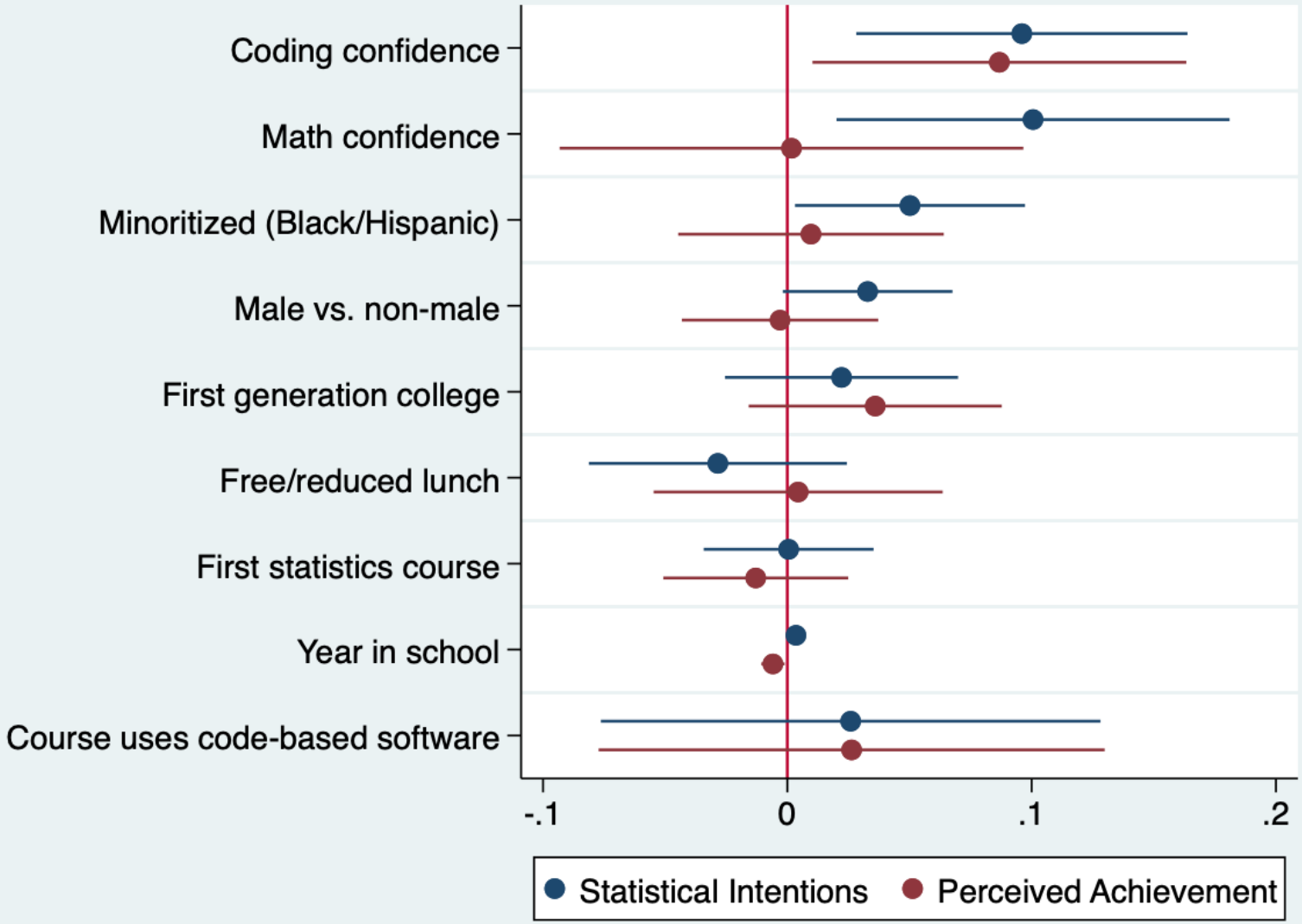

Code-based software = Stata, SAS, or R versus SPSS or StatCrunch
Residual standard deviation = 0.19 (0.18, 0.20) and 0.20 (0.18, 0.21)

Conclusions

Past research suggests that the course attracts under-represented students who may not otherwise take a statistics courses and improves their interest in further statistics courses.

Project-based course participants had intentions to take more statistics courses, but students with greater pre-course math and coding self-efficacy experienced greater gains.

Project-based courses could benefit from using brief, evidence-based interventions at the start of the term to improve coding and math self-efficacy.