



Effects of STEM/STEAM Activities on Middle School Student Attitudes, Beliefs, and Perceptions of Learning and Career Paths

A Systematic Literature Review

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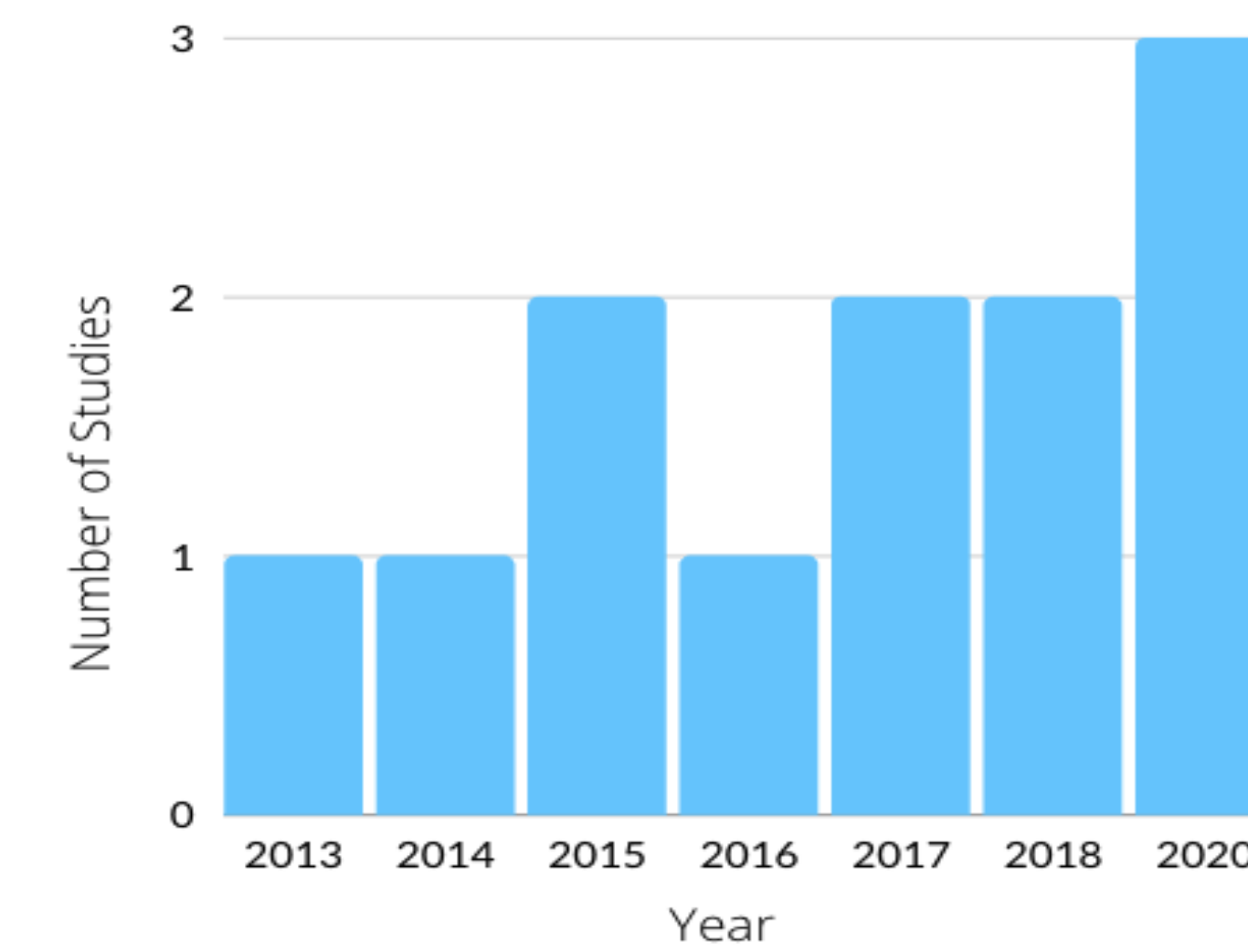
Abstract

Hispanic, Native American, and Black students are underrepresented in STEM/STEAM coursework and are more likely to drop out of STEM/STEAM degree programs in comparison to their Asian and White peers. Our findings suggest this perceived lack of participation in STEM/STEAM professions has little to do with intellectual capabilities and everything to do with the students' attitudes, beliefs, and perceptions of STEM/STEAM careers. Research suggests the two main reasons for students' apathy towards STEM/STEAM learning and career pathways are a lack of qualified instructors and innovative learning opportunities. In this poster presentation, we introduce the preliminary results of a systematic literature review on the effects of innovative STEM/STEAM activities on career perceptions of underrepresented middle school students. We utilized the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method to conduct this systematic review. Using our inclusion/exclusion criteria we restricted the results to articles published in the English language during or after the year 2000. Only the articles that were published in peer-reviewed journals, appeared in conference proceedings, or were committee approved Masters or Doctoral theses were considered for further review. As a result of further screening, we identified 12 quantitative articles, 1 qualitative article, and no mixed-methods articles. Full text analysis of the 13 articles resulted in the exclusion of 1 quantitative article. The inter-rater discussion resulted in the identification of 12 articles for inclusion in the final analysis. Our initial findings indicate that STEM/STEAM Activities foster a deeper interest and improved attitudes towards STEM/STEAM careers in middle school students.

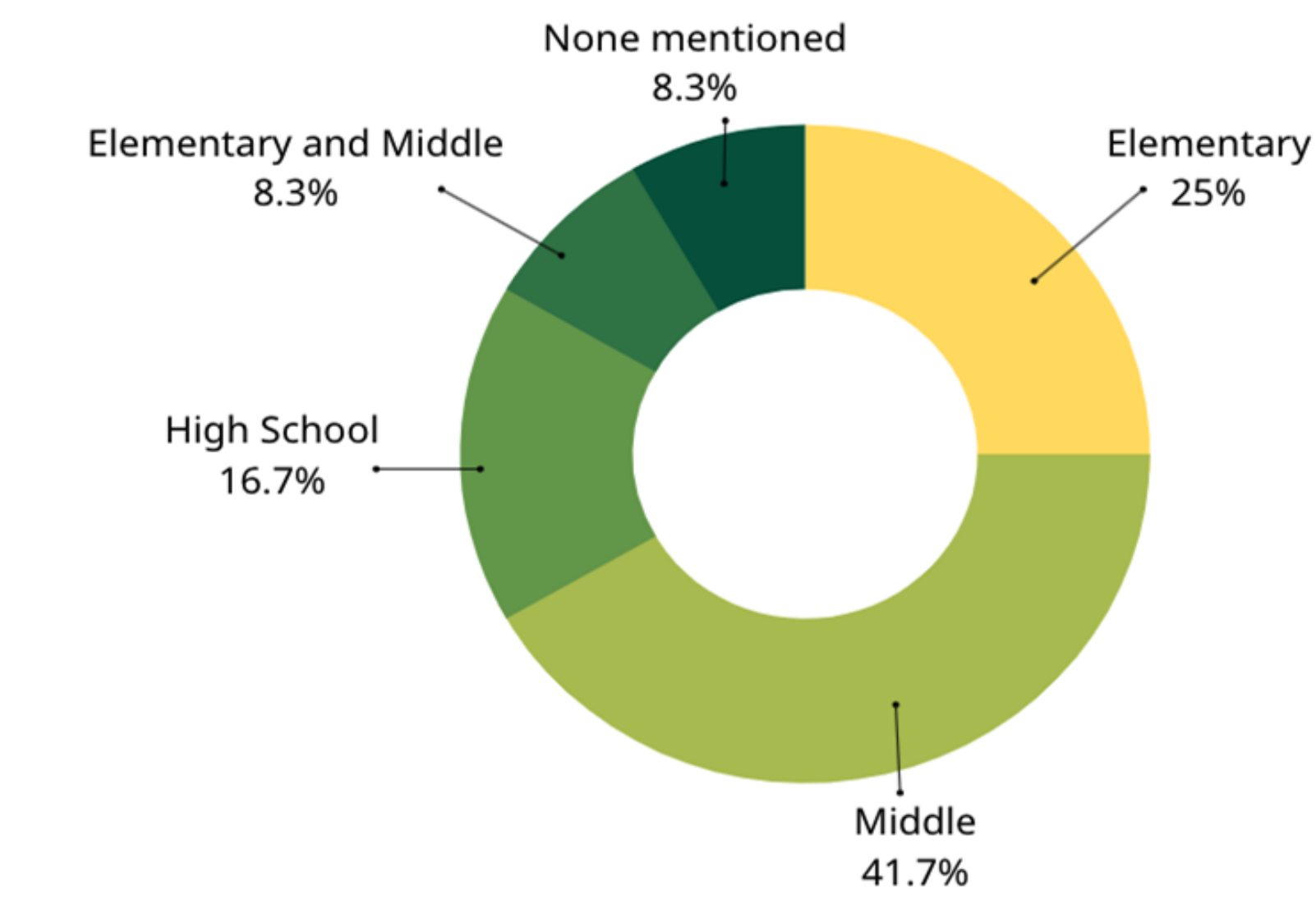
Findings

Positive Correlation
No Significant Correlation

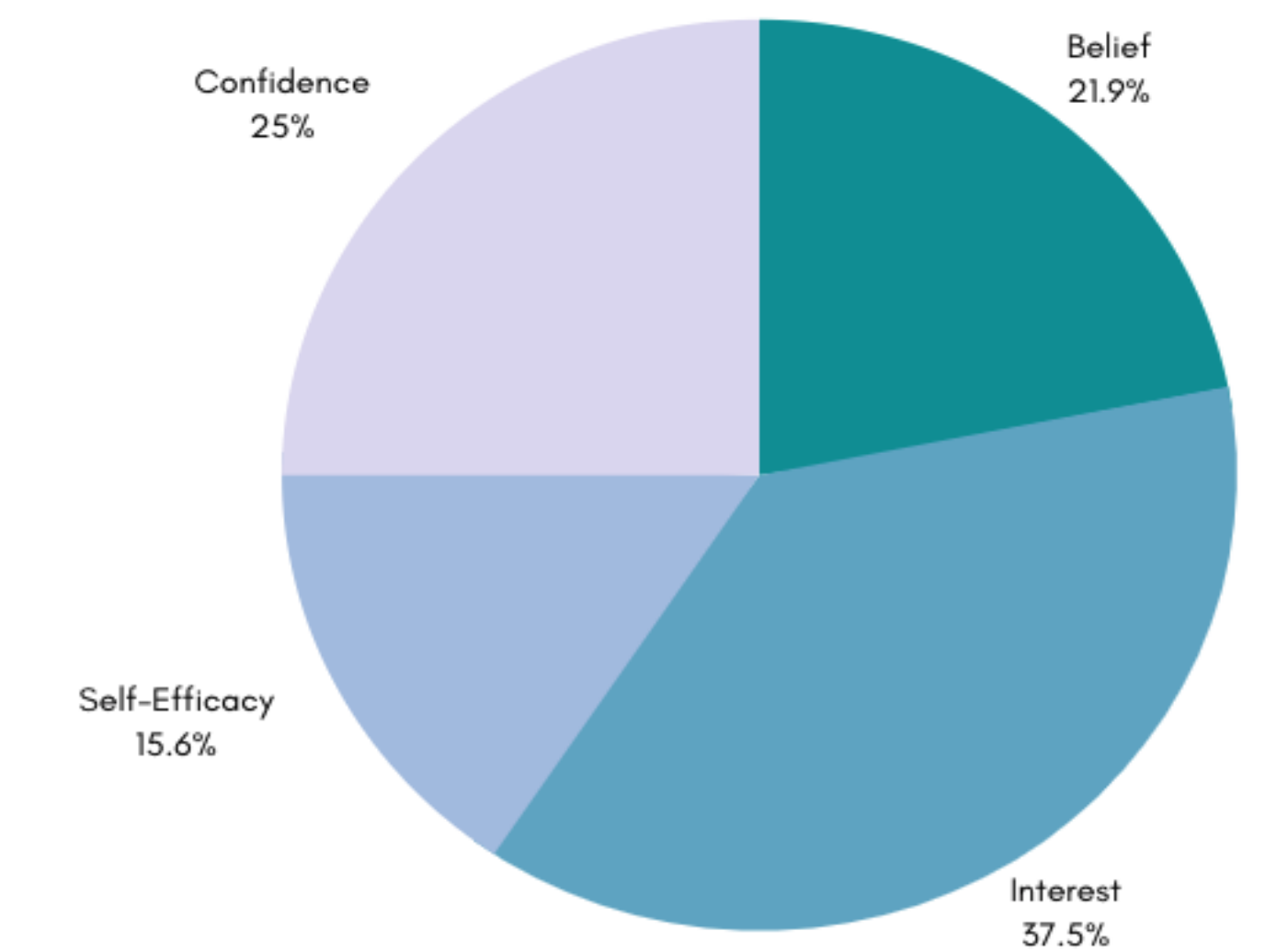
Publication Year



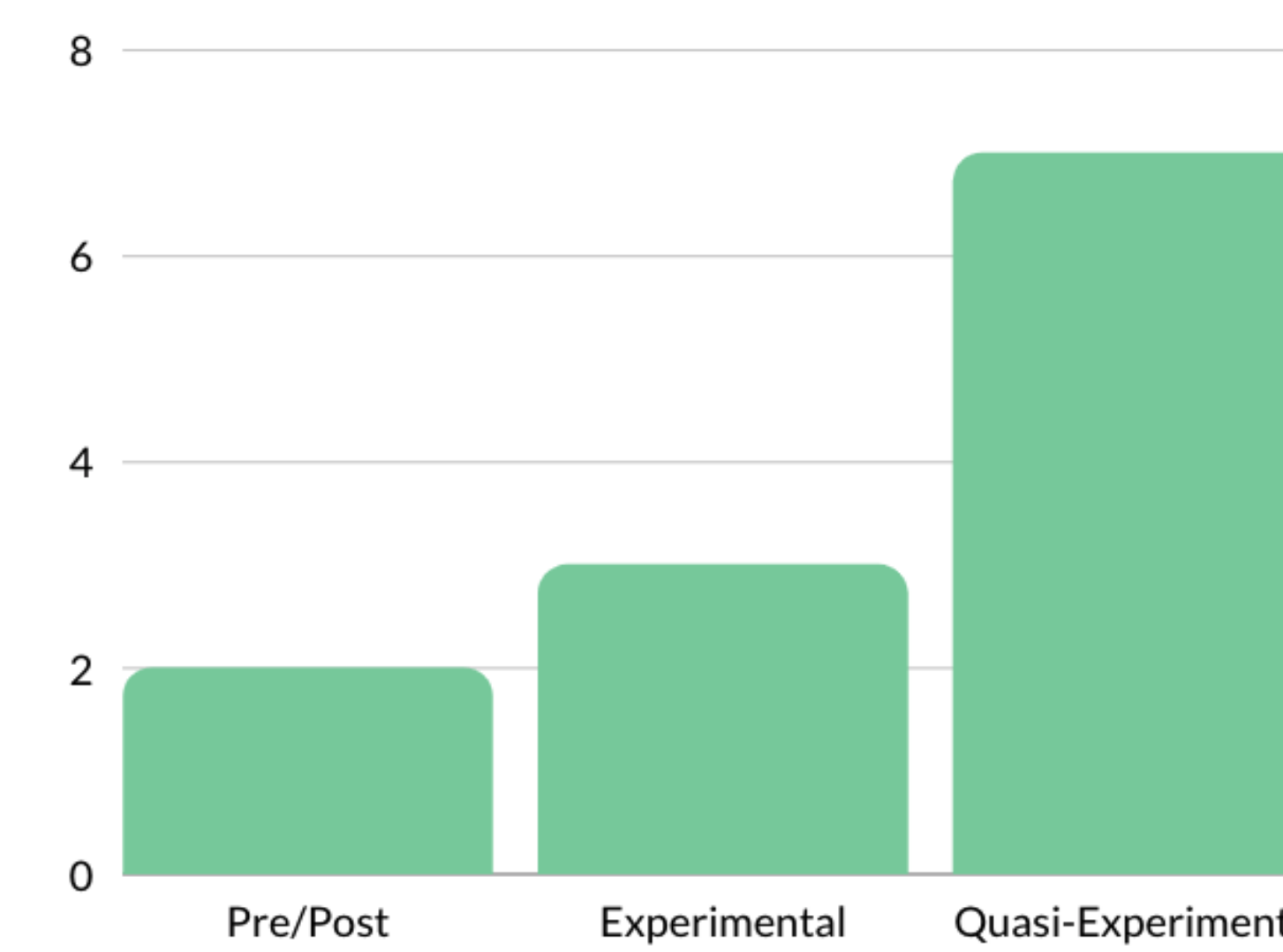
Grade Level



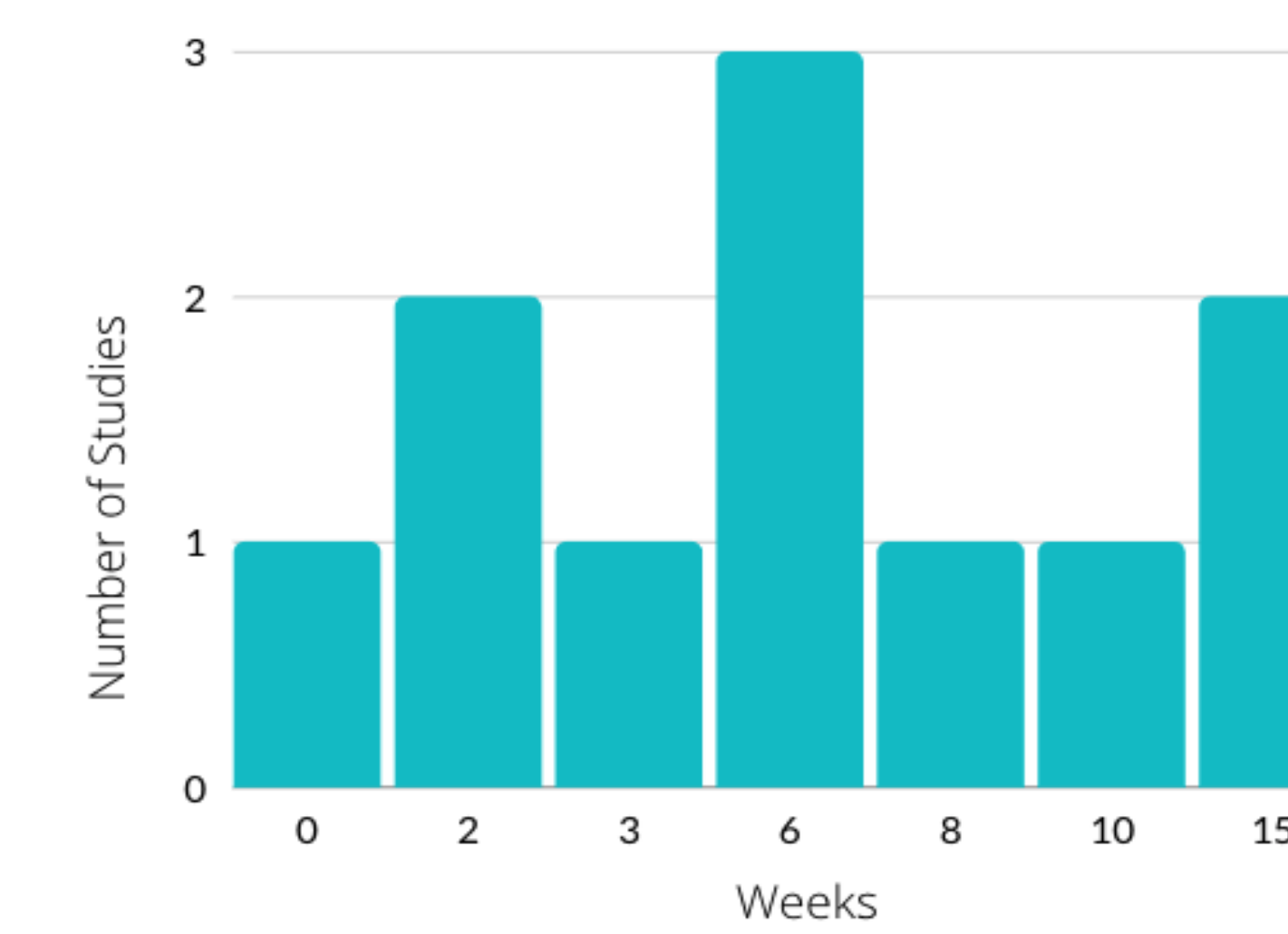
Factors Assessed



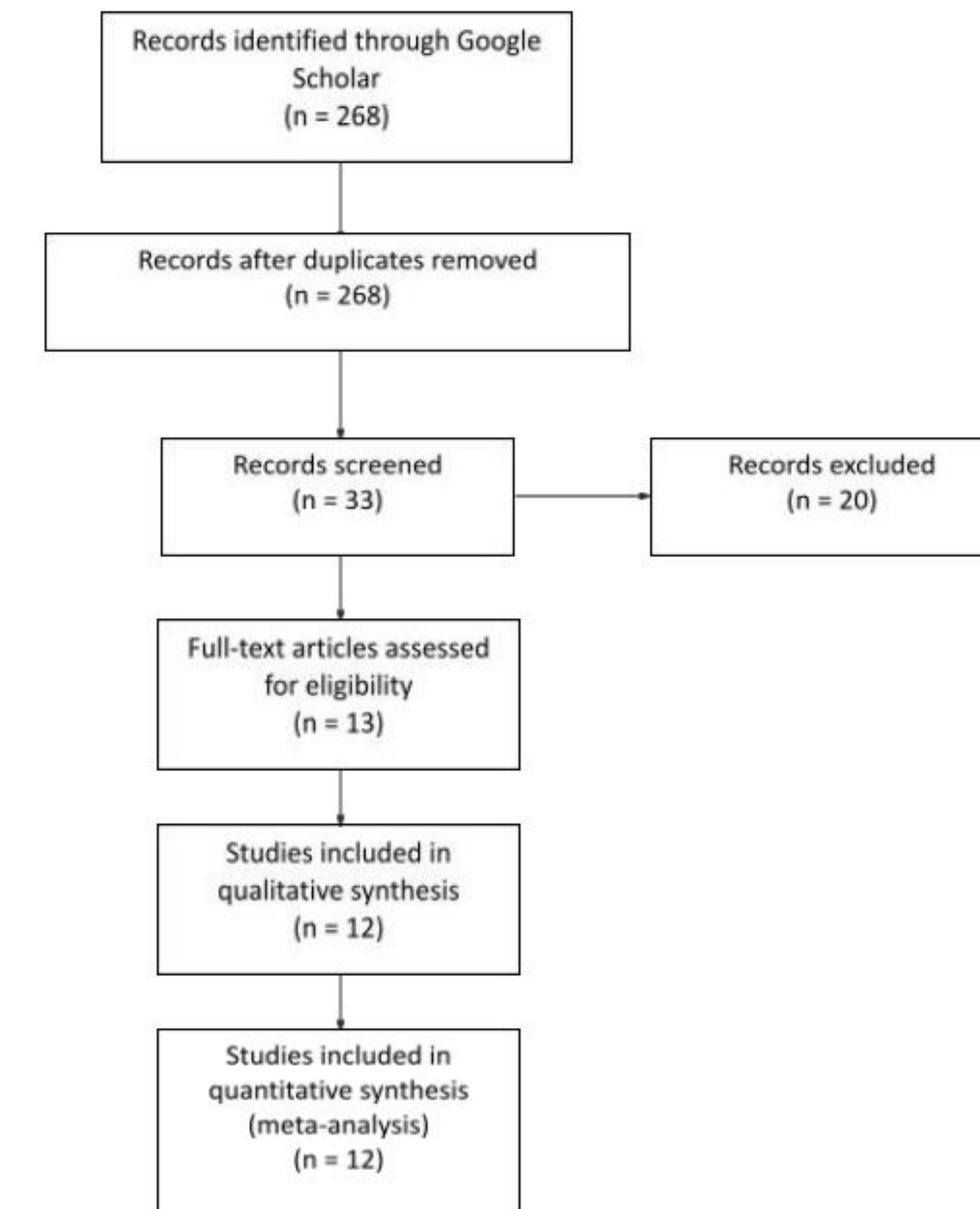
Research Design



Duration



Literature Search



Summary of Results

Authors & Years	Publication Type	Research Design	Factors Assessed	Grade Level	Duration	Summary of Results
Burt, 2014	Dissertation	Quasi Experimental	Interest and Confidence	Middle School	6 weeks	Participation in a robotics program led to high-achieving students to exhibit a strong desire to enroll in advanced math and science courses.
Carr, 2015	Dissertation	Quasi Experimental	Belief, Interest, Self-Efficacy, and Confidence	Middle School	6 weeks	African American girls did not perform as well as Caucasian girls in a similar program due to the cognitively and culturally inappropriate cyber-instruction they received.
Dzenawager, 2020	Dissertation	Experimental	Interest	Middle School	3 weeks	A STEM based forensics lesson and an engineering design challenge had little to no effect on female participants attitudes towards pursuing careers in the STEM field.
Hill, 2013	Dissertation	Pre/Post	Interest and Confidence	High School	30 weeks	There is a positive correlation between students who could consider a science career throughout duration of an after-school science program.
Jawad, 2018	Dissertation	Experimental	Interest and Confidence	High School	10 weeks	The use of art and animation while teaching programming increased the student's motivation to write and share more code.
Kendall, 2017	Dissertation	Quasi Experimental	Belief and Interest	Middle School	0 weeks	The relationships with friends and parents were found to be crucial to the students' vocational interests because they are whom the students speak to regarding post-high school plans and STEM interests.
Smith, 2015	Dissertation	Quasi Experimental	Belief, Interest, Self-Efficacy, and Confidence	Elementary and Middle School	2 weeks	There is no significant differences in attitudes towards science regardless of whether they attend a STEM afterschool program between 4th, 5th, and 6th grade African American students who attend a Title I funded school.
Stubbs, 2016	Dissertation	Quasi Experimental	Belief, Interest, Self-Efficacy, and Confidence	None Mentioned	6 weeks	The education program with active learning had a more positive impact on beliefs of all students and skills of students that are underrepresented by race or ethnicity.
Sung, 2017	Dissertation	Experimental	Interest	Elementary School	15 weeks	Self-exploratory instruction activities should be emphasized more than technical rules and skills when teaching programming activities.
Smith, Wood, 2020	Journal	Quasi Experimental	Belief and Interest	Elementary School	15.2 weeks	When there appears to be an increase in their family's interest in their academic performance, female participants had increasing academic achievement scores.
Ventresca, 2020	Dissertation	Pre/Post	Belief, Interest, Self-Efficacy, and Confidence	Elementary School	2 weeks	Exposing positive STEM role models to students at an early age can influence upper elementary students' perception of STEM careers.
Whorrall, 2018	Dissertation	Quasi Experimental	Belief, Interest, Self-Efficacy, and Confidence	Middle School	8 weeks	A web-based interactive program improved motivation in low-motivated and low-academically achieving Hispanic middle school students, emphasizing that when a student's growth tendencies are addressed, positive educational outcomes will occur.

Acknowledgments
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