Welcome to the NGCP National Webinar

Connecting Out-of-School-Time Activities and Student Interest in STEM

NATIONAL GIRLS COLLABORATIVE PROJECT

National Girls Collaborative Project

ASTC Afterschool Alliance AccessSTEM SciGirls American School Counselor Association Google Student Research Foundation

Vision

The National Girls Collaborative Project **brings together organizations** committed to informing and encouraging girls to pursue careers in science, technology, engineering, and mathematics (STEM).

NATIONAL GIRLS COLLABORATIVE PROJECT

National Girls Collaborative Project

NGCP Goals

1. **Maximize access** to shared resources within organizations interested in engaging girls in STEM.
2. **Strengthen the capacity** of programs by sharing exemplary practice research and program models.
3. **Use the leverage of a network** to achieve gender equity in STEM.

NATIONAL GIRLS COLLABORATIVE PROJECT

National Girls Collaborative Project

NGCP Model Activities

Virtually:

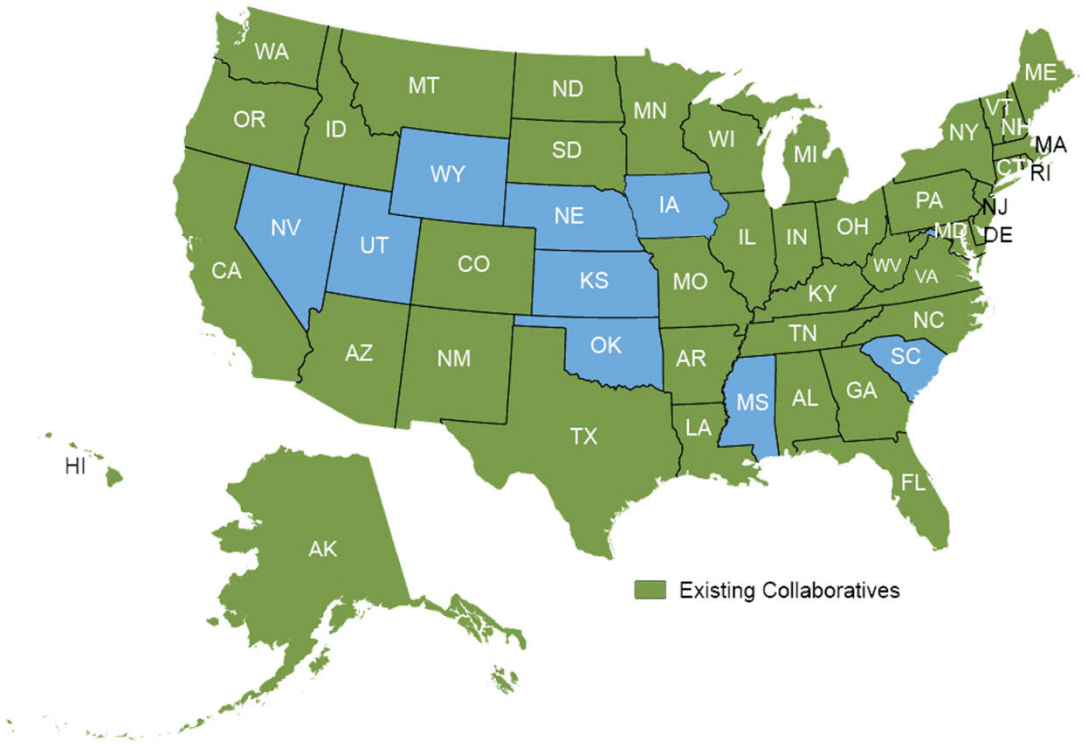
- Distribution and Content Projects
- ***The Connectory – Collaboration Tool***
- **FabFems – *Role Model Tool***
- E-Newsletter and Social Media
- Webinars – *Exemplary Practices*

Local Collaboratives:

- Professional Development: *Conferences and Forums*
- Incentives to Collaborate: *Mini-Grants*
- Newsletters and Local Resources

NATIONAL GIRLS COLLABORATIVE PROJECT

National Network of Collaborative Teams



NATIONAL GIRLS COLLABORATIVE PROJECT

National Girls Collaborative Project

Speakers

Susan Sunbury

Jacqueline Doyle

CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

Connecting Out-of-School-Time (OST) Activities and Student Interest in STEM

Susan Sunbury, Ed.D. and Jacqueline Doyle, Ph.D.

February 26, 2020

Female Representation in Out-of- School Time Science (FROSTS)

- Advance understanding of female representation in out-of-school time (OST) activities
- Identify and test the OST-related factors that are hypothesized to strengthen interest, identity and career interest in STEM, particularly for female students
- For this webinar, we will focus on STEM interest

Evaluating large-scale and long-term impacts of OST activities

- Evaluation efforts often:
  - occur on a program-by-program basis
  - have small numbers of subjects limiting statistical power
  - use measures of short-term student satisfaction
- Longitudinal studies can:
  - be expensive
  - take a long time

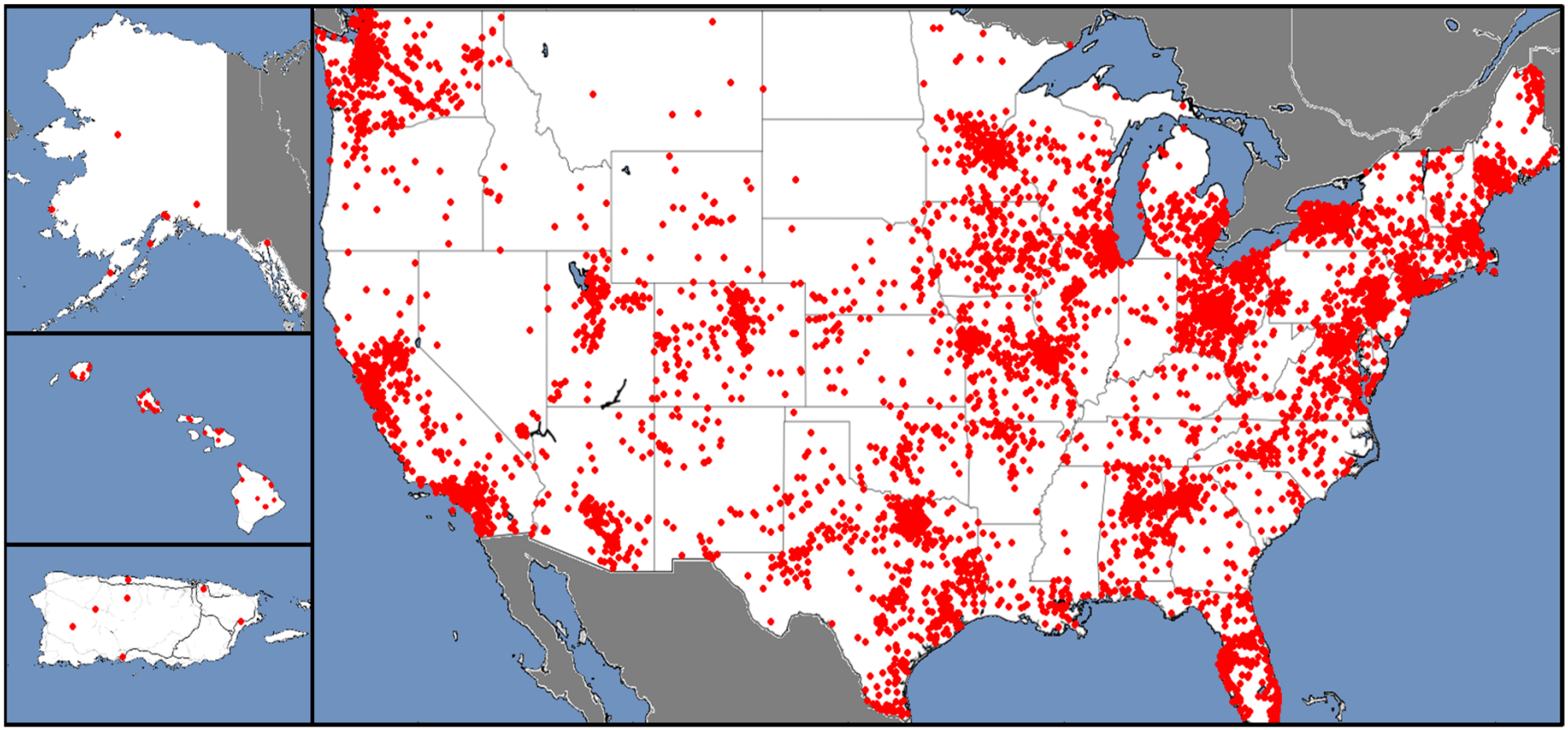
FROSTS
a retrospective cohort study

- Large scale - can obtain representative samples
- More generalizable than small-scale evaluations of specific programs
- Can test the strength of multiple hypotheses
- Can be completed in a short time frame

The FROSTS survey

- Asked students to recall earlier experiences
- Questions based on review of relevant literature, survey of stakeholders and survey students
- Survey pilot tested then sent to over 30,000 students in compulsory first-year courses (English/writing)
- Schools chosen from a stratified random sample of two-year and four-year community colleges and universities

Final nationally representative sample 15,725



Survey questions

- Comprehensive survey - 33 questions (20 minutes)
  - **STEM interest**
  - STEM identity
  - Career interest and motivation
  - Participation in OST activities – structured and unstructured
  - Subjects taken in school/grades/scores
  - Family interest and involvement in STEM
  - **Access and barriers to participation**
  - Demographics

Measuring STEM interest

at the end of middle school and again at the end of high school

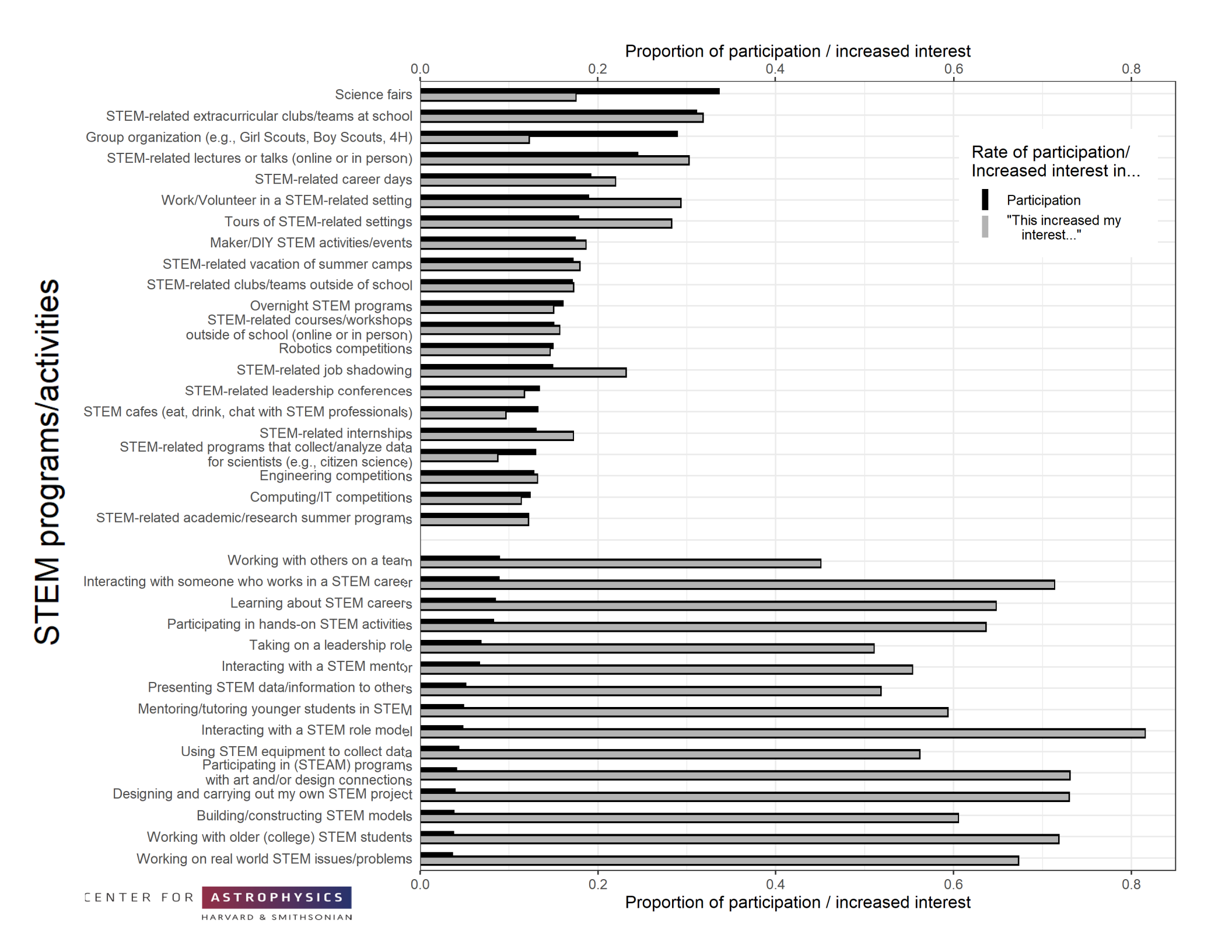
	Not interested At all					Extremely Interested
	0	1	2	3	4	5
Science	O	O	O	O	O	O
Mathematics	O	O	O	O	O	O
Engineering	O	O	O	O	O	O
Computing	O	O	O	O	O	O

Types of STEM activities (examples)

	If you participated in any of these activities, please mark how often and in which grades you participated				This activity increased my interest in STEM
	5-8		9-12		
	Sometimes	Often	Sometimes	Often	Mark if yes
STEM-related extracurricular clubs/teams at school	O	O	O	O	O
STEM-related clubs/teams outside of school	O	O	O	O	O
Group organization (e.g., Girl Scouts, Boy Scouts, 4H)	O	O	O	O	O
Maker/DIY STEM activities/events	O	O	O	O	O
Overnight STEM programs (museums, science centers etc.)	O	O	O	O	O

Opportunities within STEM activities (examples)

	I experienced this STEM opportunity	This opportunity increased my interest in STEM	This opportunity showed the real-life relevance of STEM
	Mark if yes	Mark if yes	Mark if yes
Interacting with a STEM mentor	O	O	O
Interacting with a STEM role model	O	O	O
Taking on a leadership role	O	O	O
Participating in hands-on STEM activities	O	O	O
Using STEM equipment to collect data	O	O	O
Learning about STEM careers	O	O	O


Proportion of participation / increased interest
0.0
0.2
0.4
0.6
0.8
STEM programs/activities
Science fairs
STEM-related extracurricular clubs/teams at school
Group organization (e.g., Girl Scouts, Boy Scouts, 4H)
STEM-related lectures or talks (online or in person)
STEM-related career days
Work/Volunteer in a STEM-related setting
Tours of STEM-related settings
Maker/DIY STEM activities/events
STEM-related vacation of summer camps
STEM-related clubs/teams outside of school
Overnight STEM programs
STEM-related courses/workshops outside of school (online or in person)
Robotics competitions
STEM-related job shadowing
STEM-related leadership conferences
STEM cafes (eat, drink, chat with STEM professionals)
STEM-related internships
STEM-related programs that collect/analyze data for scientists (e.g., citizen science)
Engineering competitions
Computing/IT competitions
STEM-related academic/research summer programs
Working with others on a team
Interacting with someone who works in a STEM career
Learning about STEM careers
Participating in hands-on STEM activities
Taking on a leadership role
Interacting with a STEM mentor
Presenting STEM data/information to others
Mentoring/tutoring younger students in STEM
Interacting with a STEM role model
Using STEM equipment to collect data
Participating in (STEAM) programs with art and/or design connections
Designing and carrying out my own STEM project
Building/constructing STEM models
Working with older (college) STEM students
Working on real world STEM issues/problems
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
0.0
0.2
0.4
0.6
0.8
Proportion of participation / increased interest
CENTER FOR ASTROPHYSICS
HARVARD & SMITHSONIAN

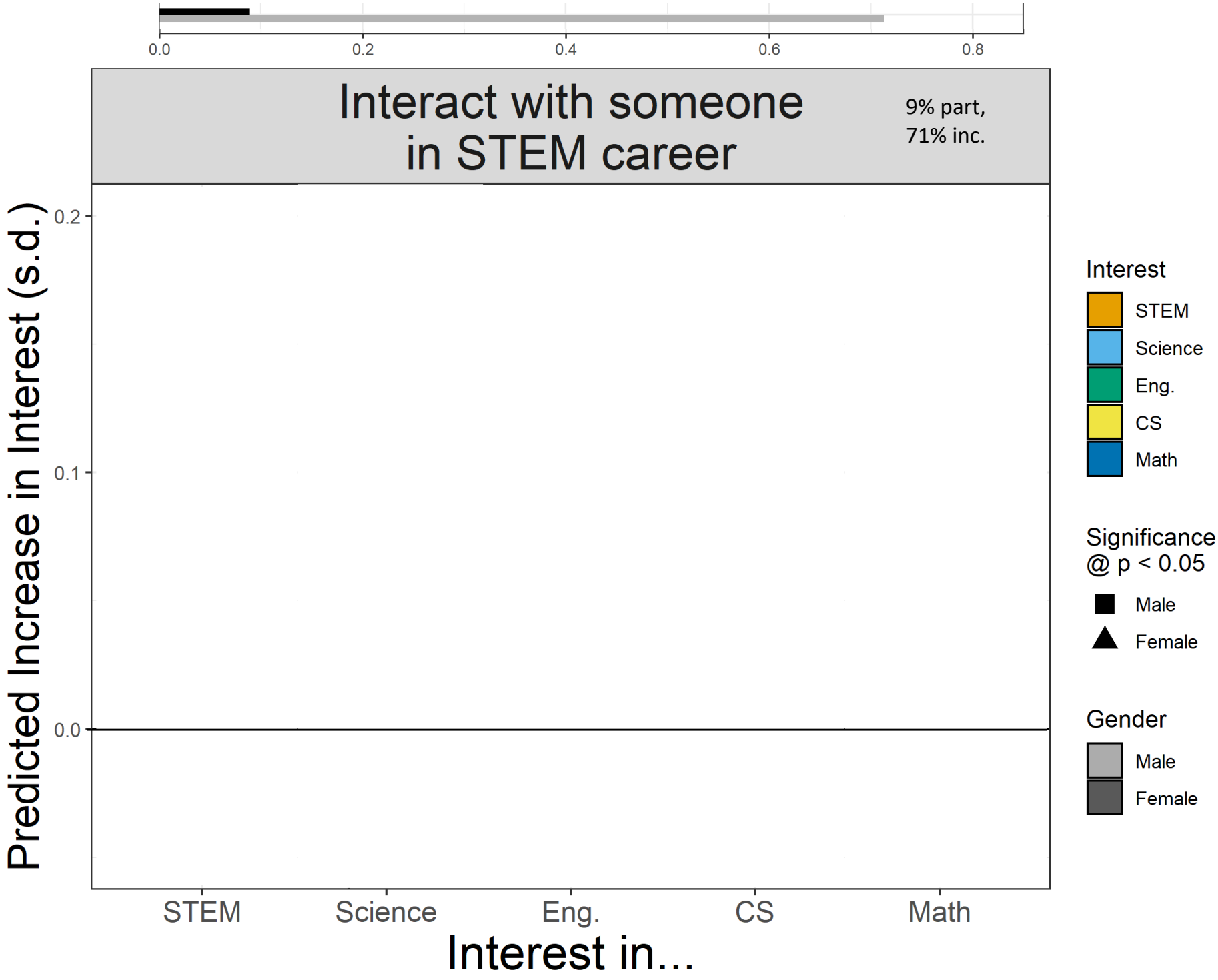
How effective is “this increased my interest”?

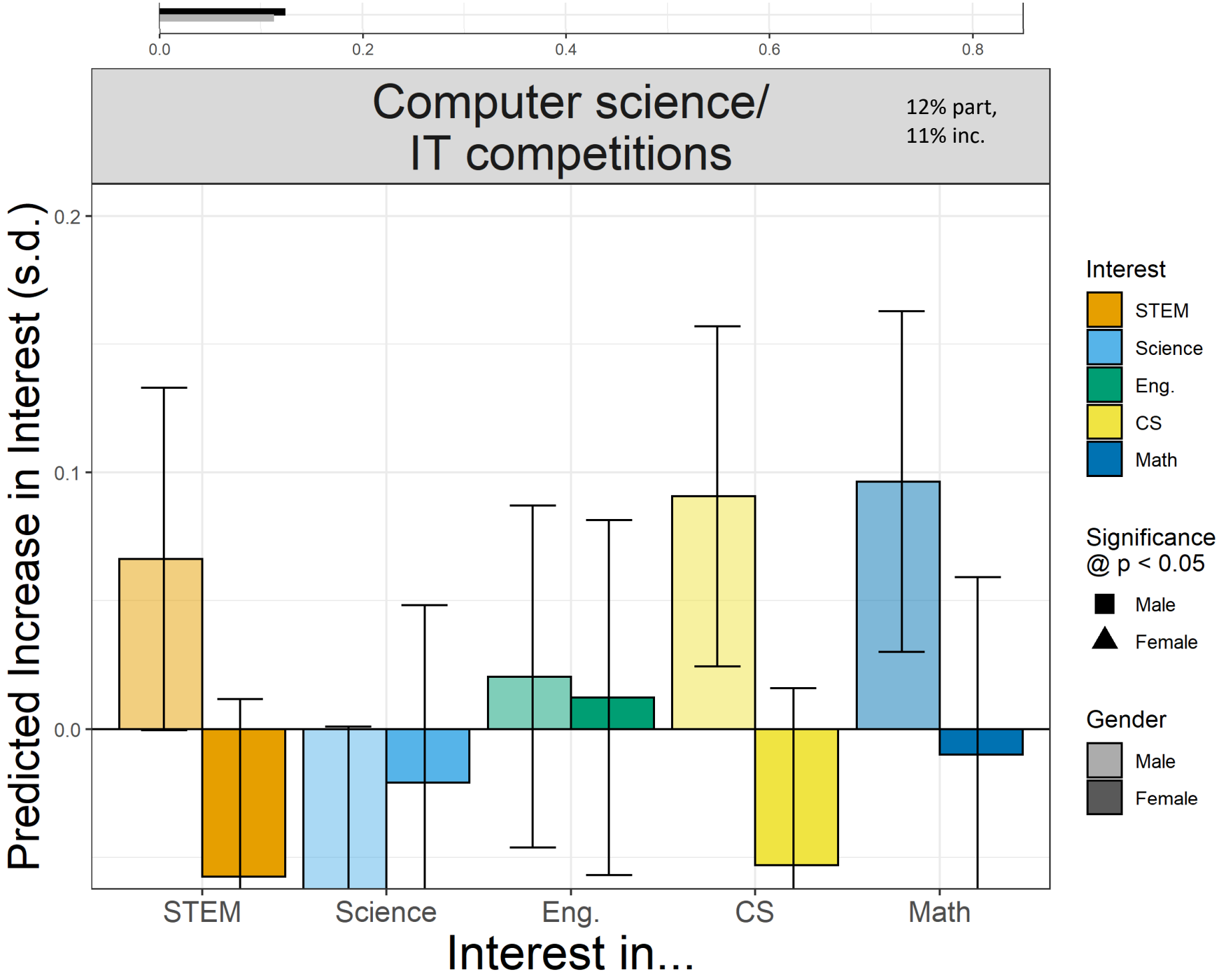
- We built models predicting increases in five types of interest (each of the four in the question, plus an “overall STEM interest” which is indicated by the highest score in any interest), based on:
  - Whether they did the activity in question
  - Their gender

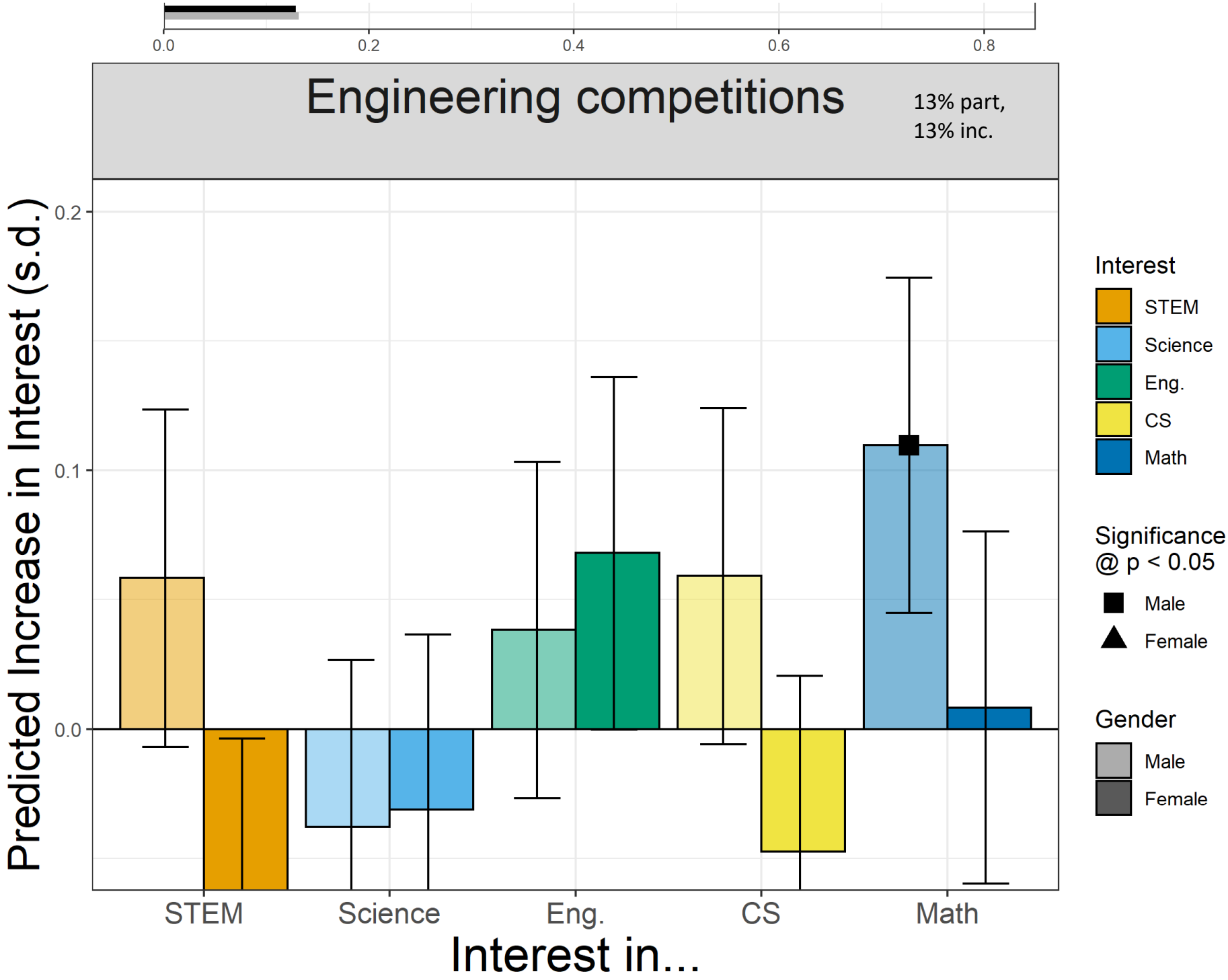
- Deliberately simplistic model that seeks to measure the size of an effect more than explain why it happens with covariates

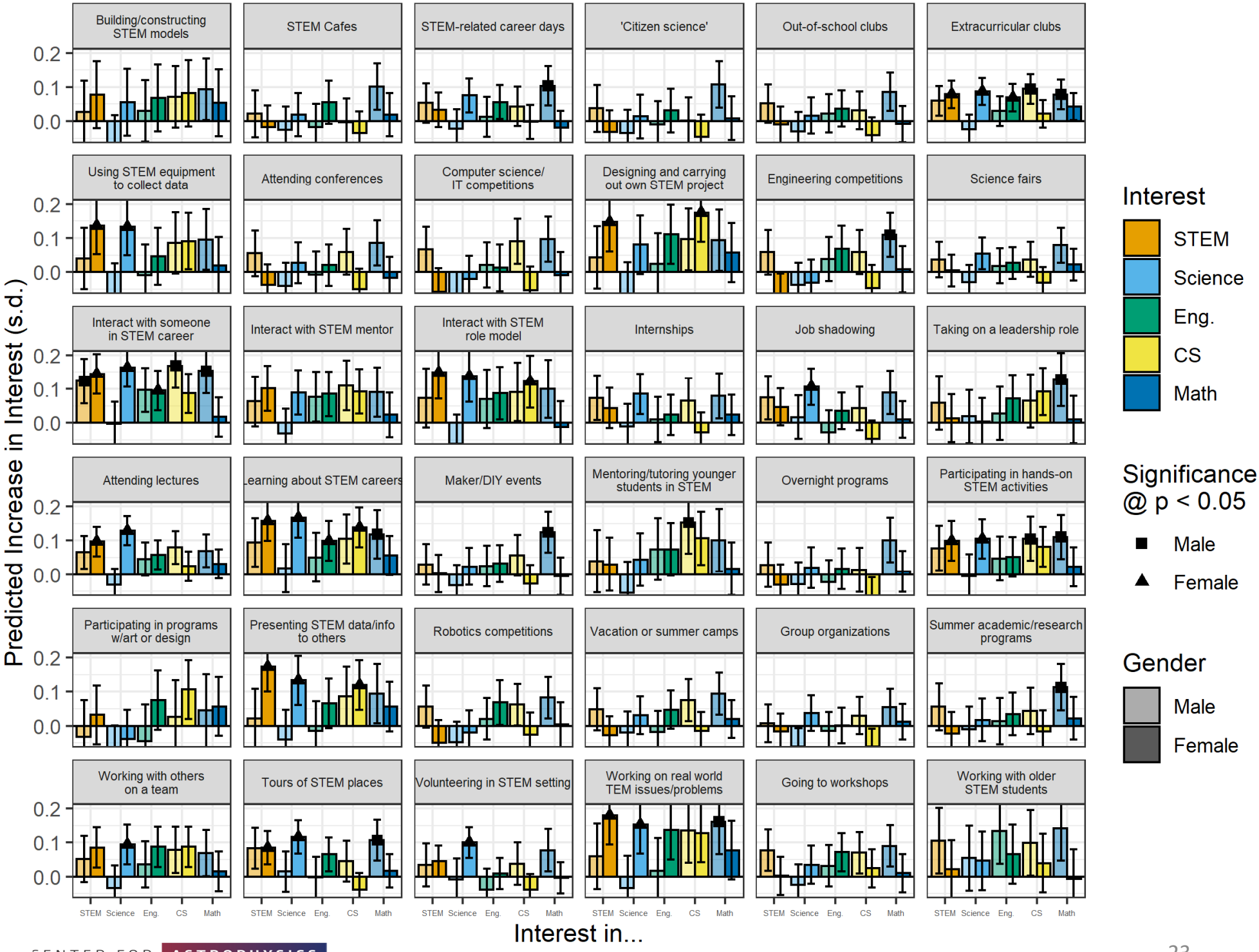
How effective is “this increased my interest”?

- Significance (p-values) needed to get adjusted for the large number of models and variables we were processing independently
- The direct effect of “doing the activity” was never significantly different from zero
- For those who said the activity increased their interest in STEM, doing the activity had varying effects, depending on WHICH type of interest we were predicting


0.0
0.2
0.4
0.6
0.8
Interact with someone in STEM career
9% part, 71% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Computer science/
IT competitions
12% part,
11% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Engineering competitions
13% part,
13% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female



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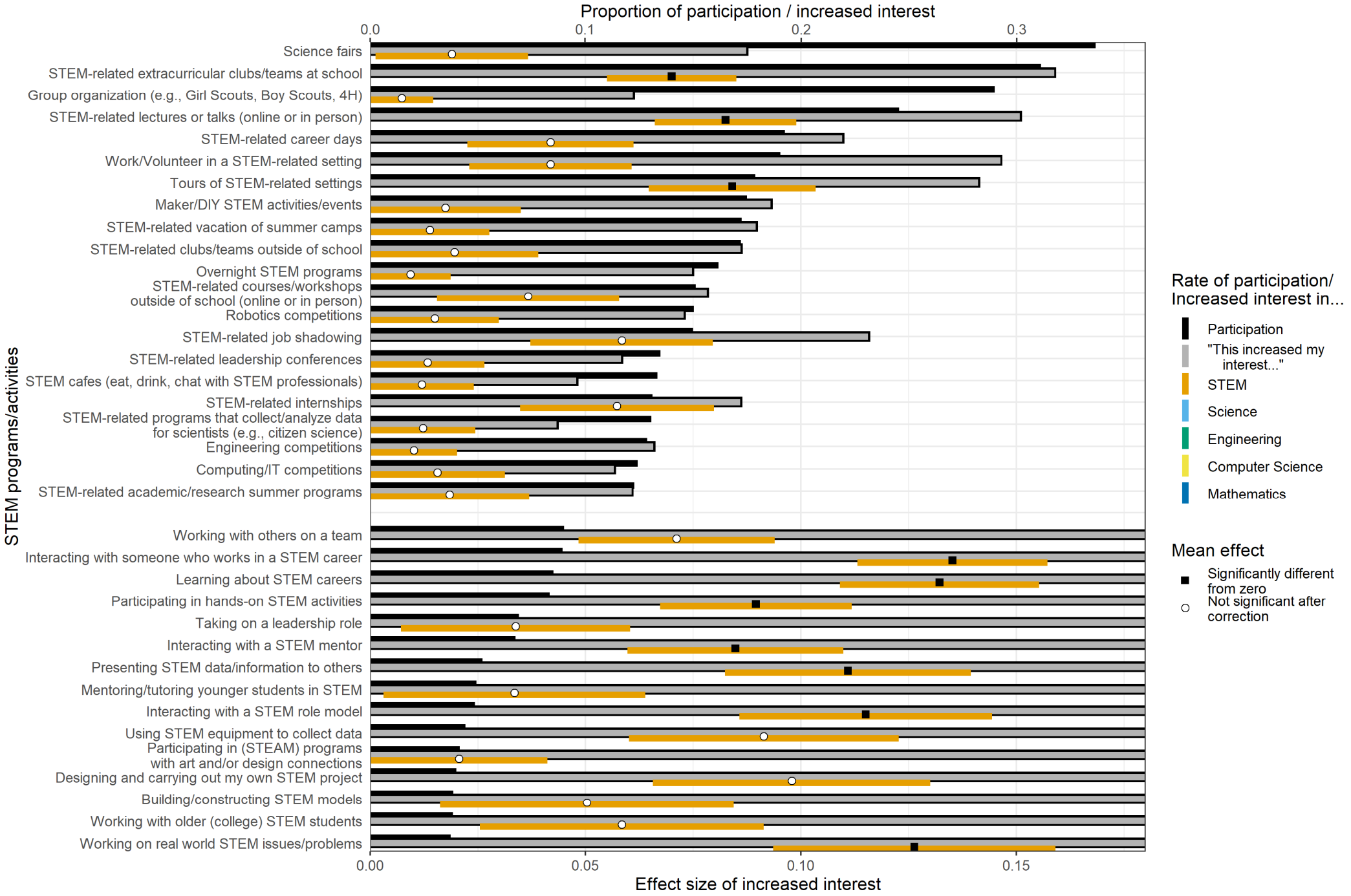
HARVARD & SMITHSONIAN


Proportion of participation / increased interest
0.0
0.1
0.2
0.3
Science fairs
STEM-related extracurricular clubs/teams at school
Group organization (e.g., Girl Scouts, Boy Scouts, 4H)
STEM-related lectures or talks (online or in person)
STEM-related career days
Work/Volunteer in a STEM-related setting
Tours of STEM-related settings
Maker/DIY STEM activities/events
STEM-related vacation of summer camps
STEM-related clubs/teams outside of school
Overnight STEM programs
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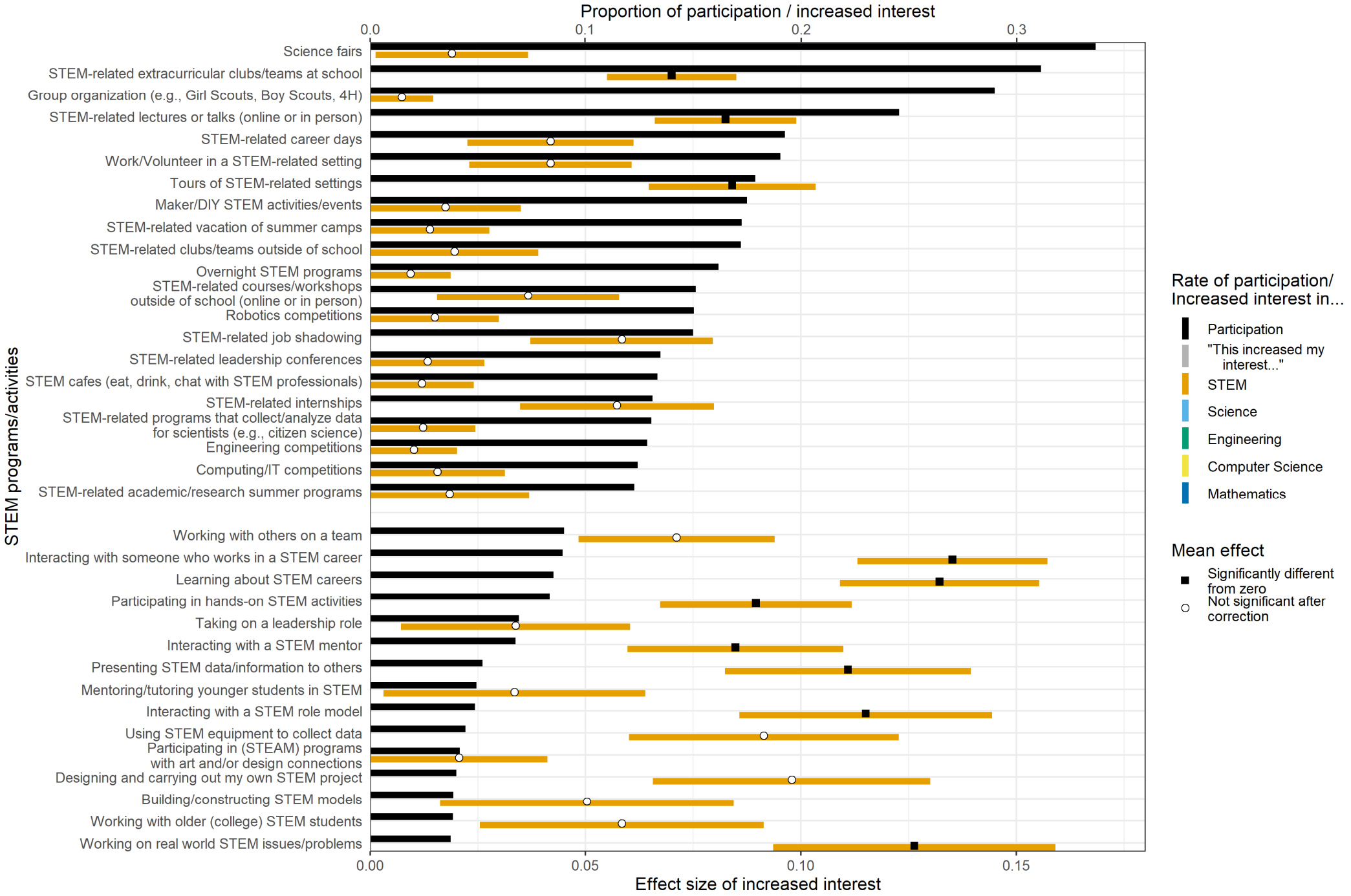
Engineering competitions
Computing/IT competitions
STEM-related academic/research summer programs
Working with others on a team
Interacting with someone who works in a STEM career
Learning about STEM careers
Participating in hands-on STEM activities
Taking on a leadership role
Interacting with a STEM mentor
Presenting STEM data/information to others
Mentoring/tutoring younger students in STEM
Interacting with a STEM role model
Using STEM equipment to collect data
Participating in (STEAM) programs with art and/or design connections
Designing and carrying out my own STEM project
Building/constructing STEM models
Working with older (college) STEM students
Working on real world STEM issues/problems
STEM programs/activities
0.00
0.05
0.10
0.15
Effect size of increased interest
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
STEM
Science
Engineering
Computer Science
Mathematics
Mean effect
Significantly different from zero
Not significant after correction


Proportion of participation / increased interest
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0.1
0.2
0.3
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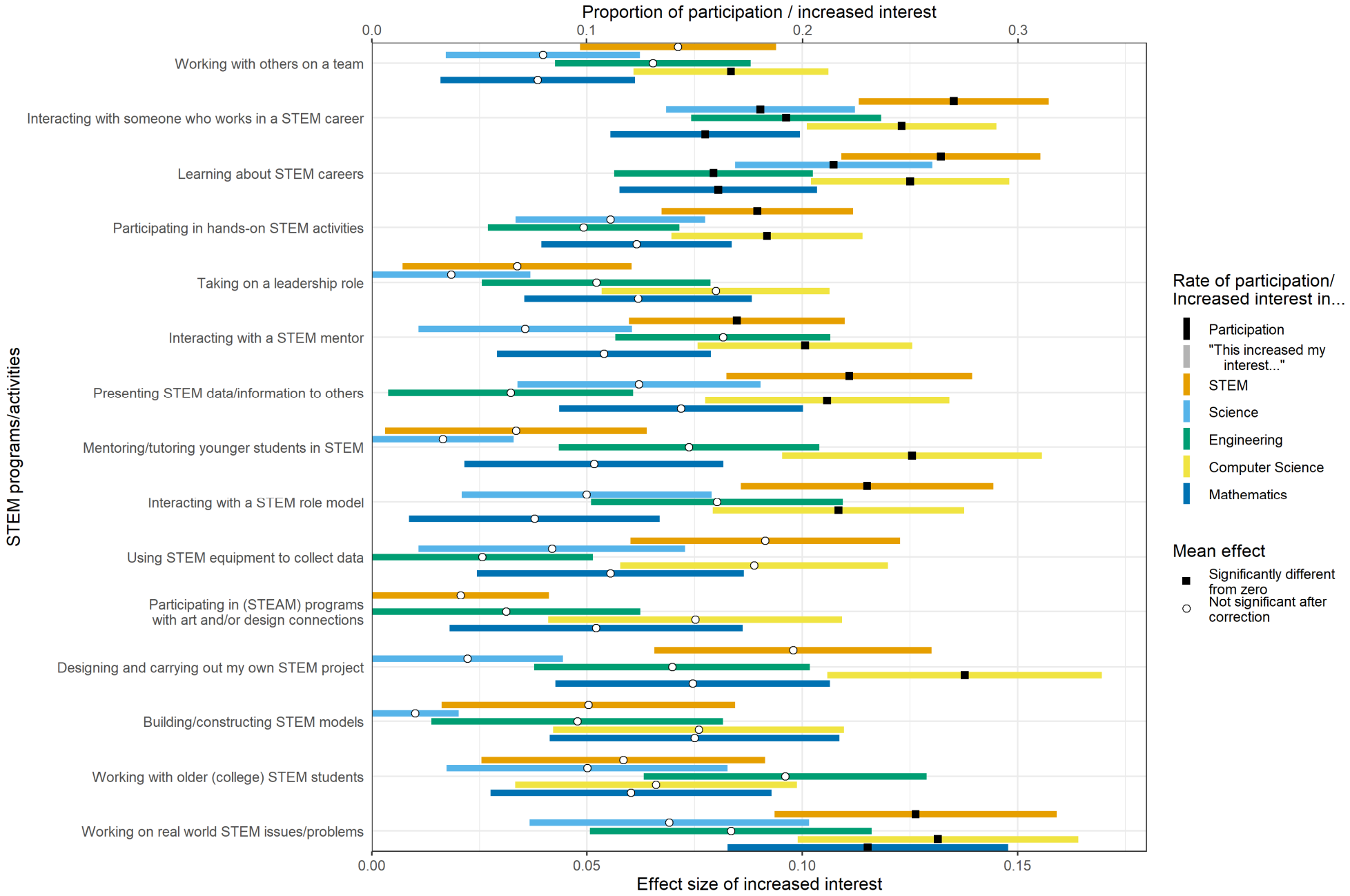
STEM programs/activities
0.00
0.05
0.10
0.15
Effect size of increased interest
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
STEM
Science
Engineering
Computer Science
Mathematics
Mean effect
Significantly different from zero
Not significant after correction


Proportion of participation / increased interest
0.0
0.1
0.2
0.3
STEM programs/activities
Working with others on a team
Interacting with someone who works in a STEM career
Learning about STEM careers
Participating in hands-on STEM activities
Taking on a leadership role
Interacting with a STEM mentor
Presenting STEM data/information to others
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Interacting with a STEM role model
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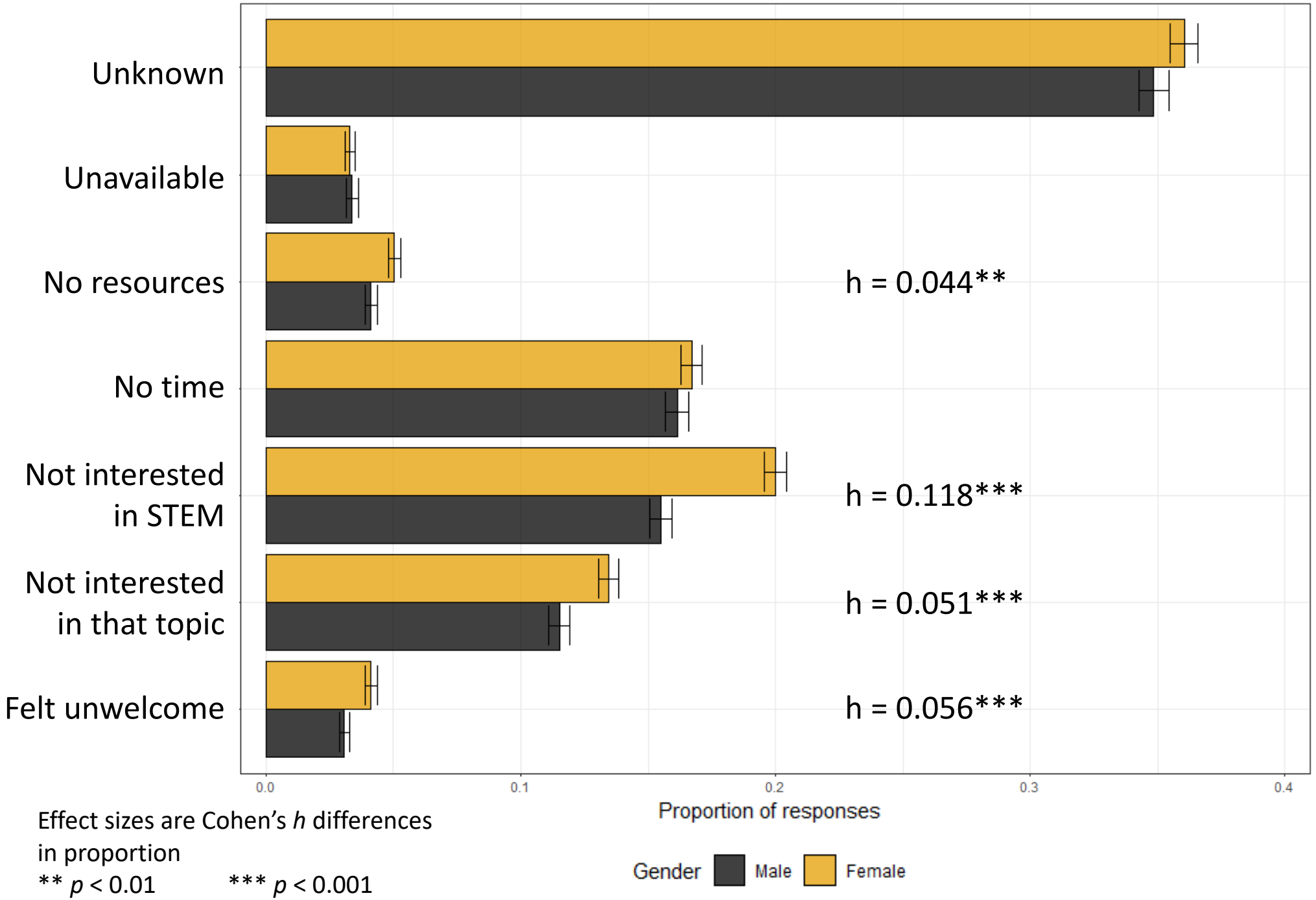
0.00
0.05
0.10
0.15
Effect size of increased interest
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
STEM
Science
Engineering
Computer Science
Mathematics
Mean effect
Significantly different from zero
Not significant after correction

Barriers to involvement

Q20. If you did NOT attend any STEM programs/activities outside of school, please indicate why. *Mark all that apply*.

❑ I didn't know STEM opportunities were available in my area	Unknown
❑ I looked, but there were no STEM opportunities available in my area	Unavailable
❑ STEM opportunities were available but I didn't have the time (other commitments: work/home/other activities) to attend	No time
❑ STEM opportunities were available but I didn't have the resources (transportation/finances) to attend	No resources
❑ STEM opportunities were available but I was not interested in the specific topics offered	Not interested in that topic
❑ STEM opportunities were available but I was not interested in STEM	Not interested in STEM
❑ STEM opportunities were available but I didn't feel welcome/comfortable attending	Felt unwelcome



Effect sizes are Cohen's *h* differences in proportion

** $p < 0.01$ *** $p < 0.001$

Discussion question

What actions can you take as a result of what you learned/heard at the webinar?

What questions still need to be answered, but require additional research?

Thank you

Any questions?

This work was supported by NSF Grant Nos. 1612375 and 1611985 Any views are the authors own and do not necessarily reflect the views of the National Science Foundation

Upcoming NGCP Webinar

The STEM Effect: A collaborative action agenda for understanding the long-term impacts of STEM programs on girls

Wednesday, March 25, 2020

11:00am Pacific | 2:00 PM Eastern

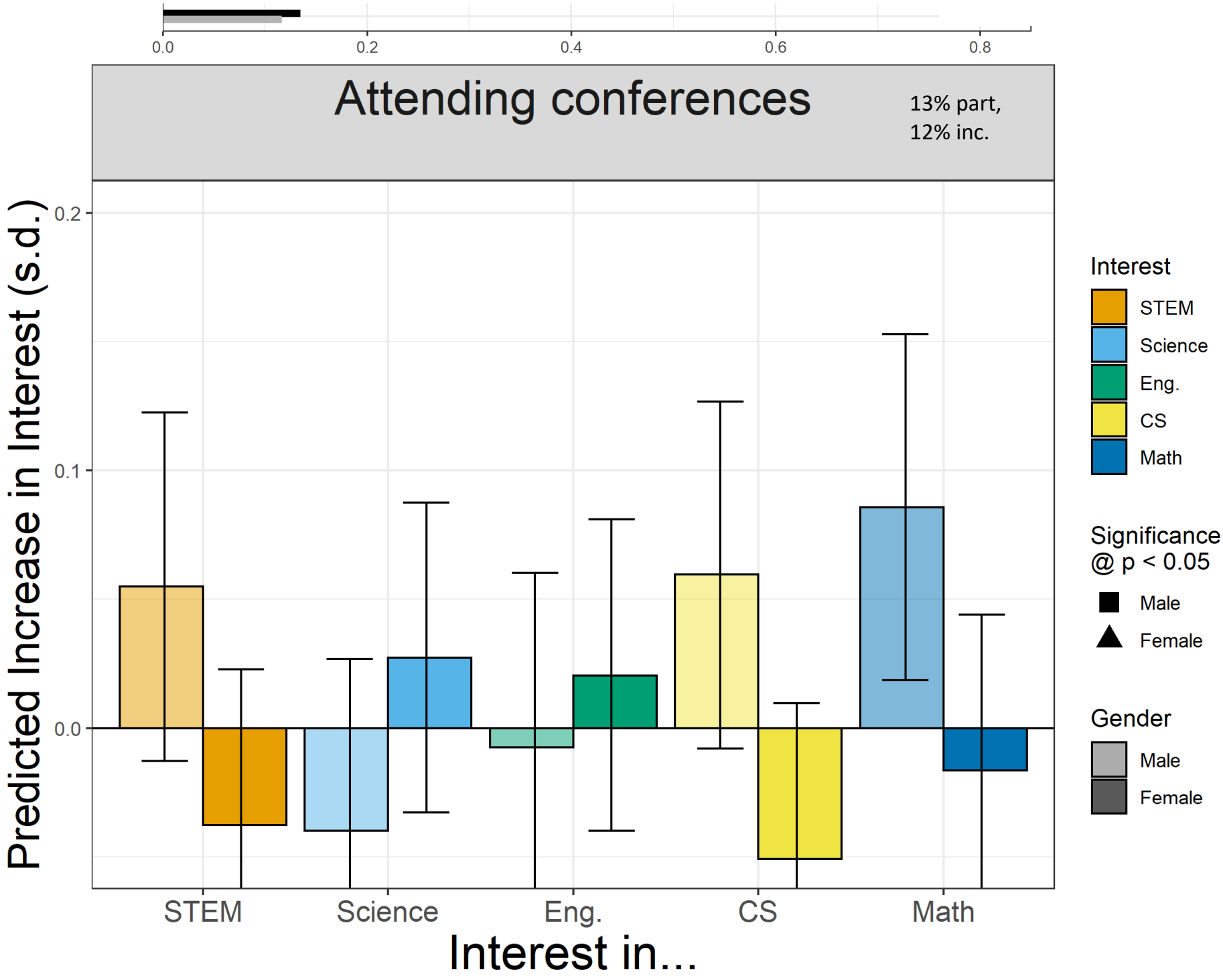
The STEM Effect

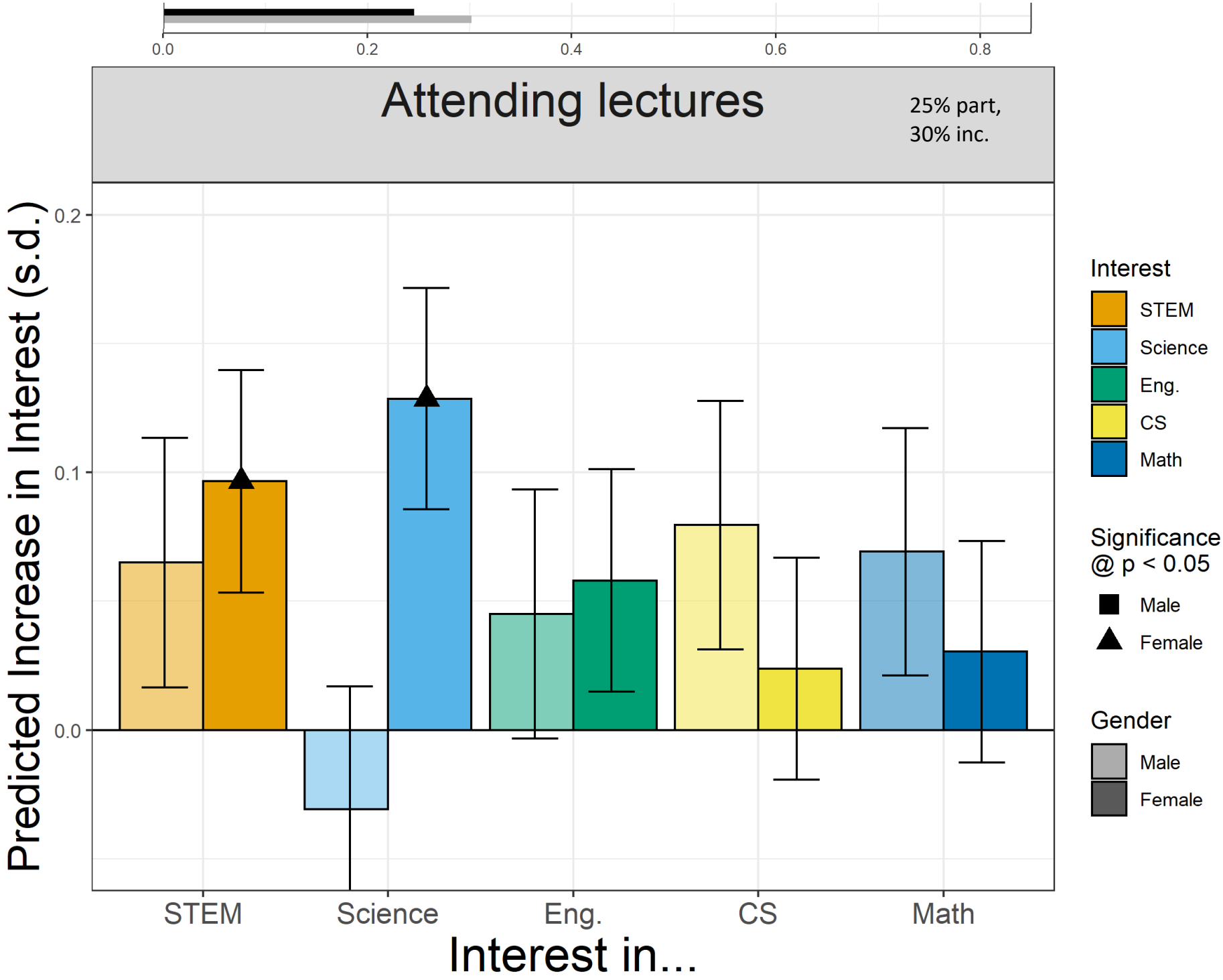
INTREPID SEA, AIR & SPACE MUSEUM COMPLEX

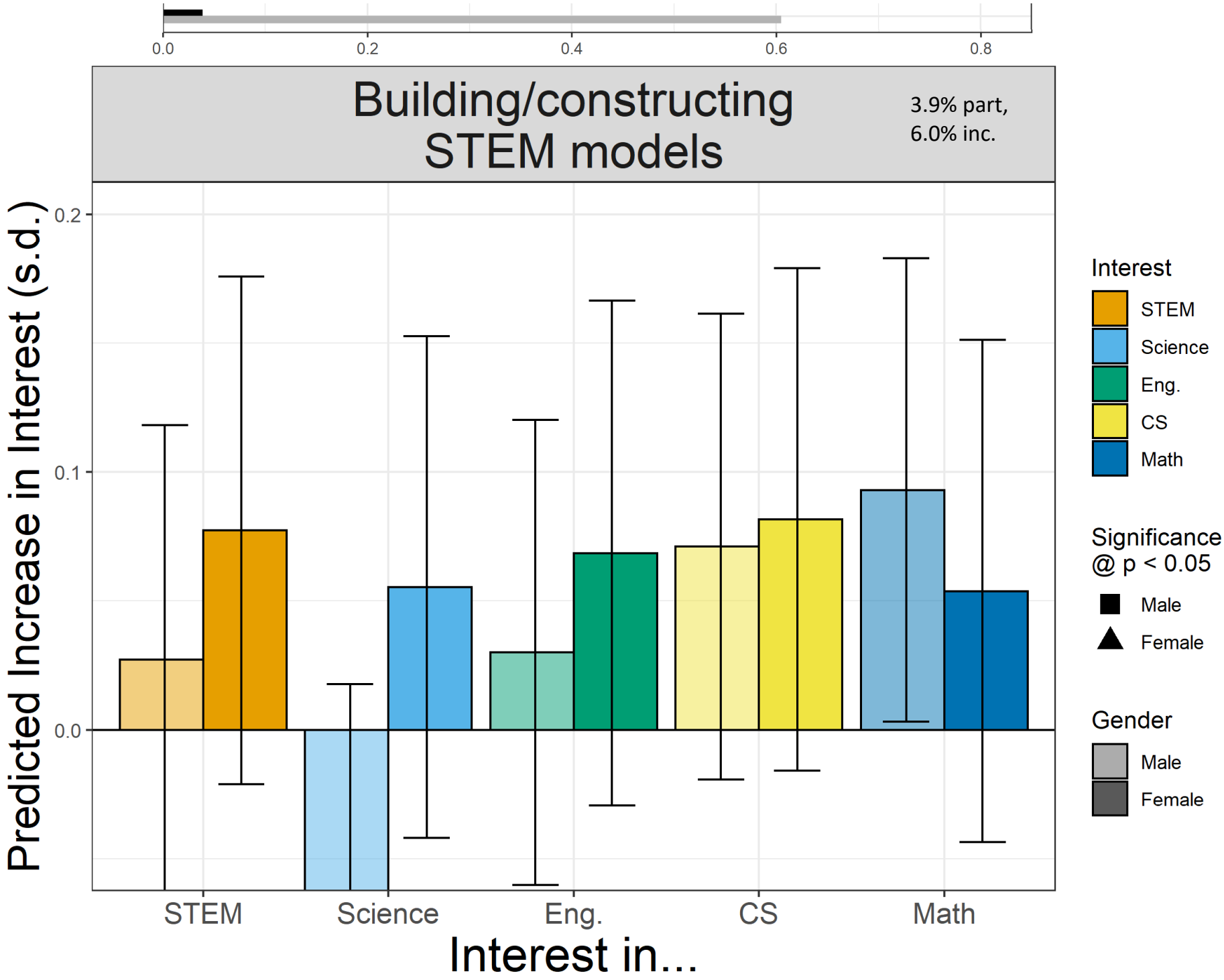
EDC Education Development Center

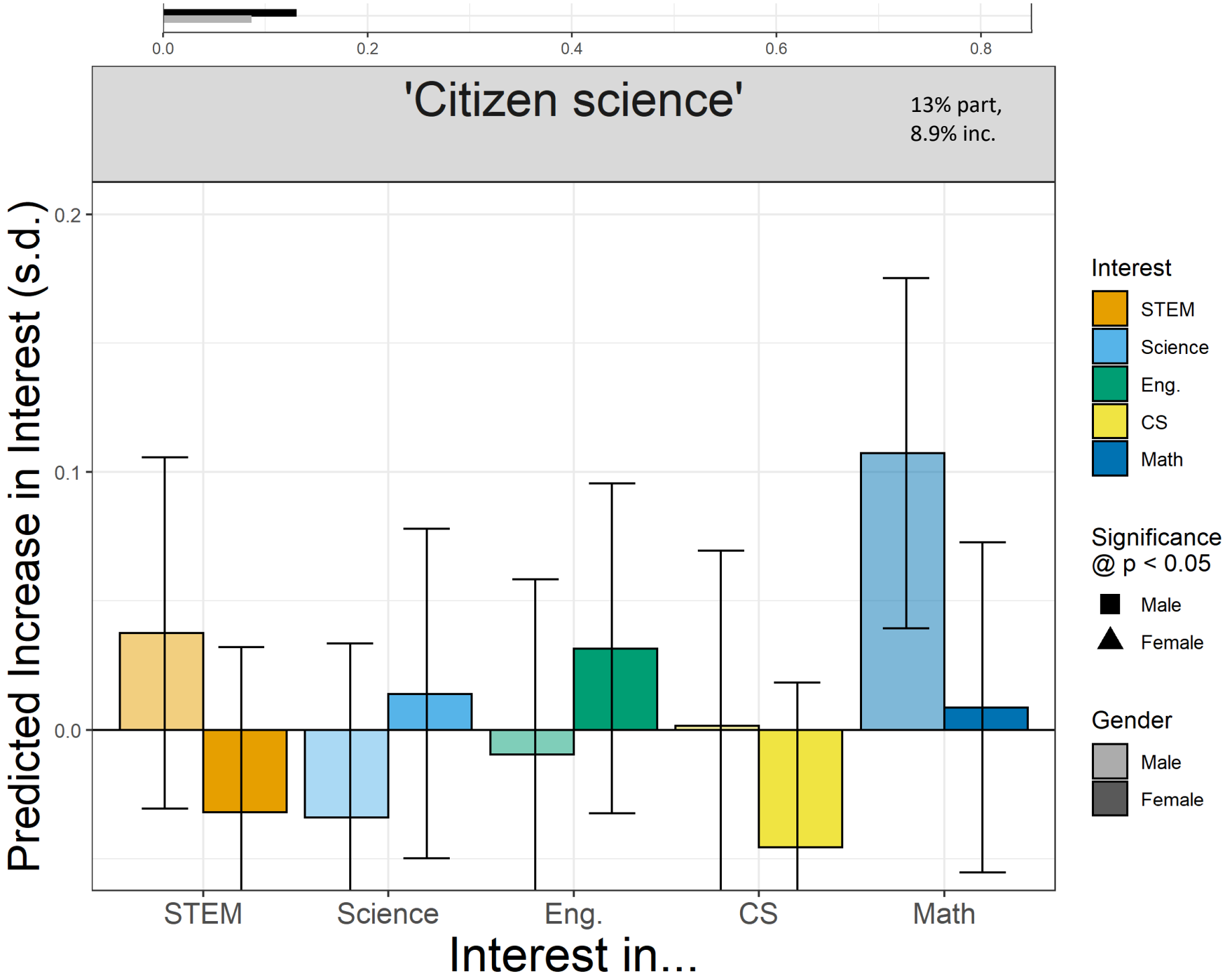
National Girls Collaborative Project

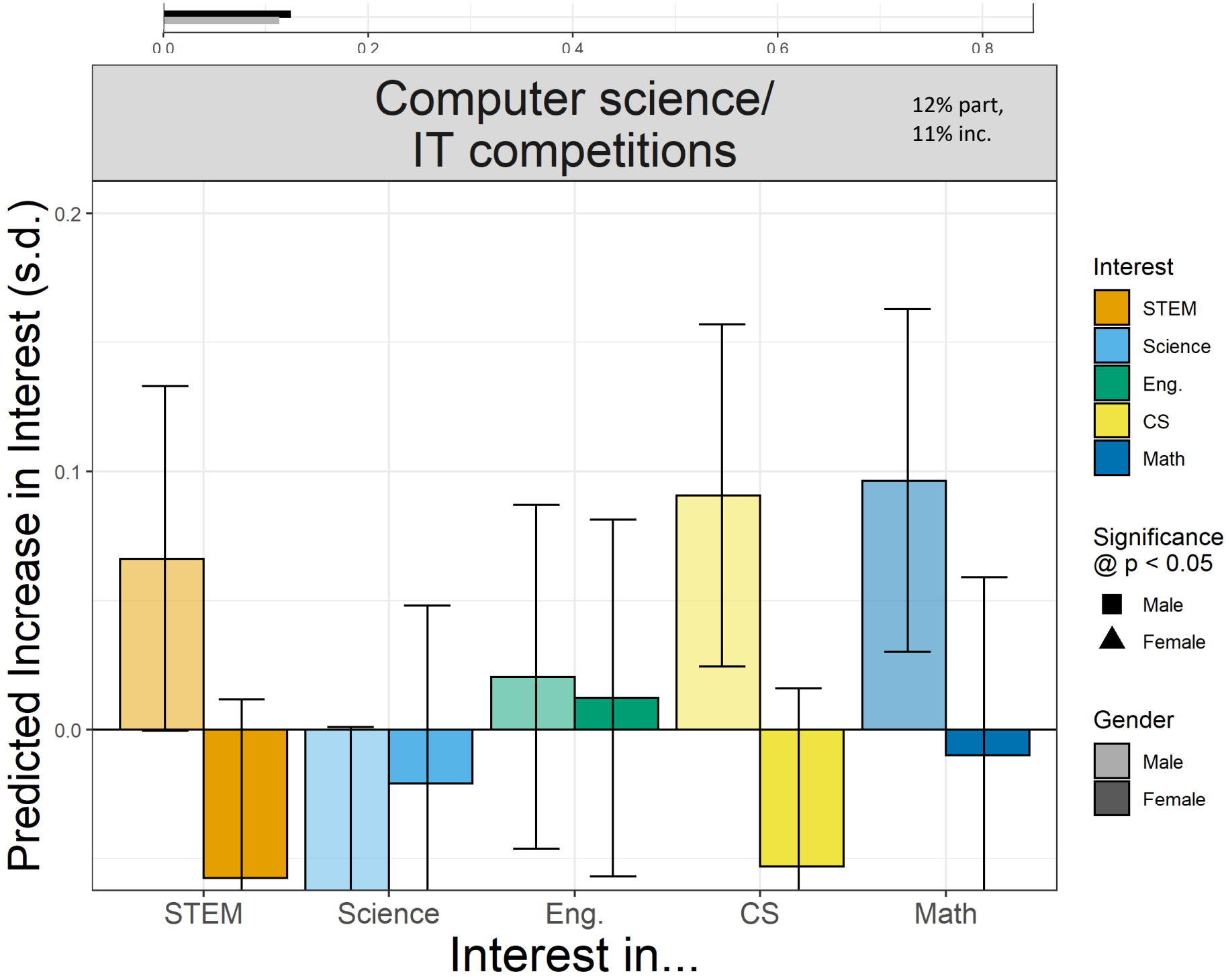
NATIONAL GIRLS COLLABORATIVE PROJECT

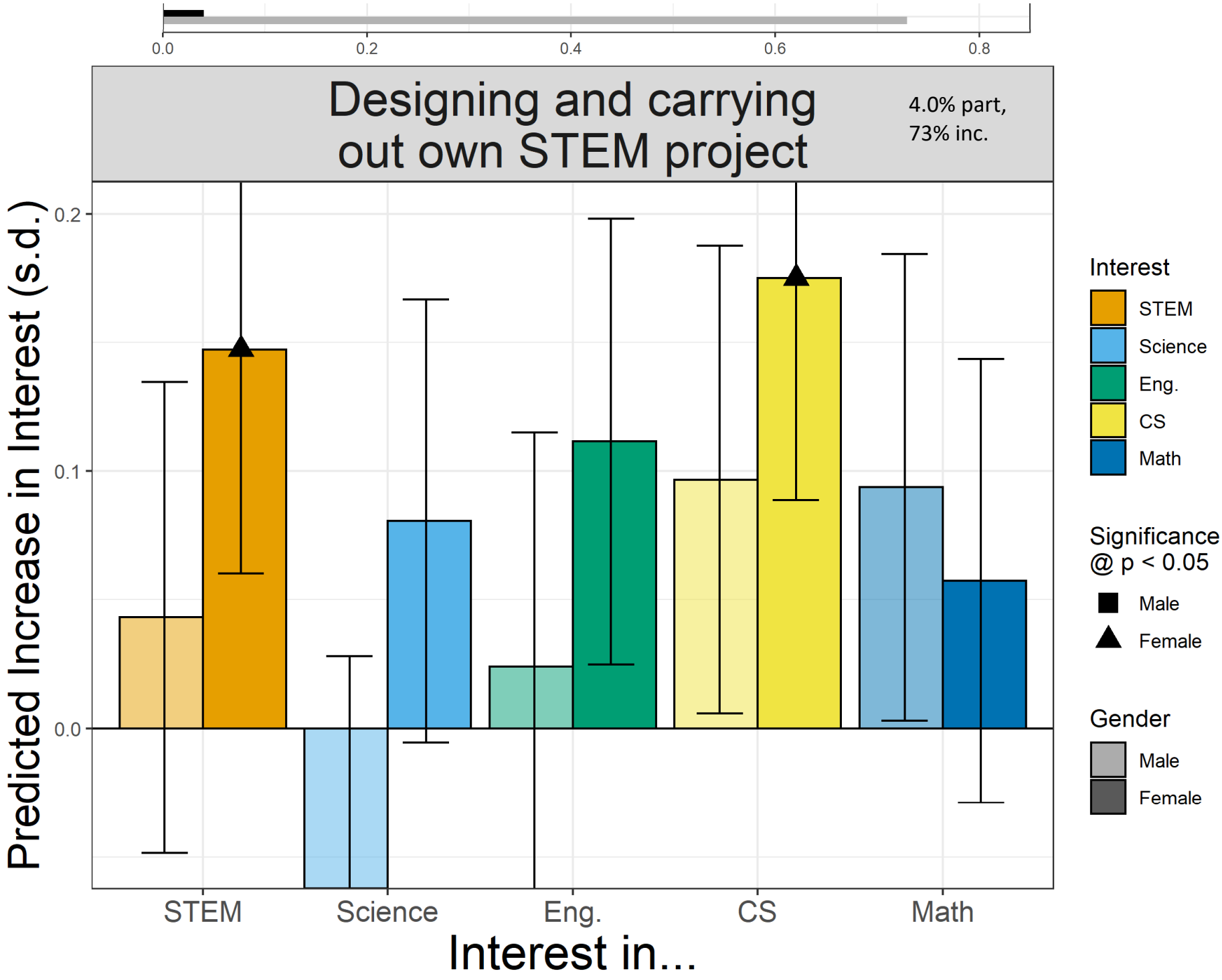

0.0
0.2
0.4
0.6
0.8
Attending conferences
13% part,
12% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

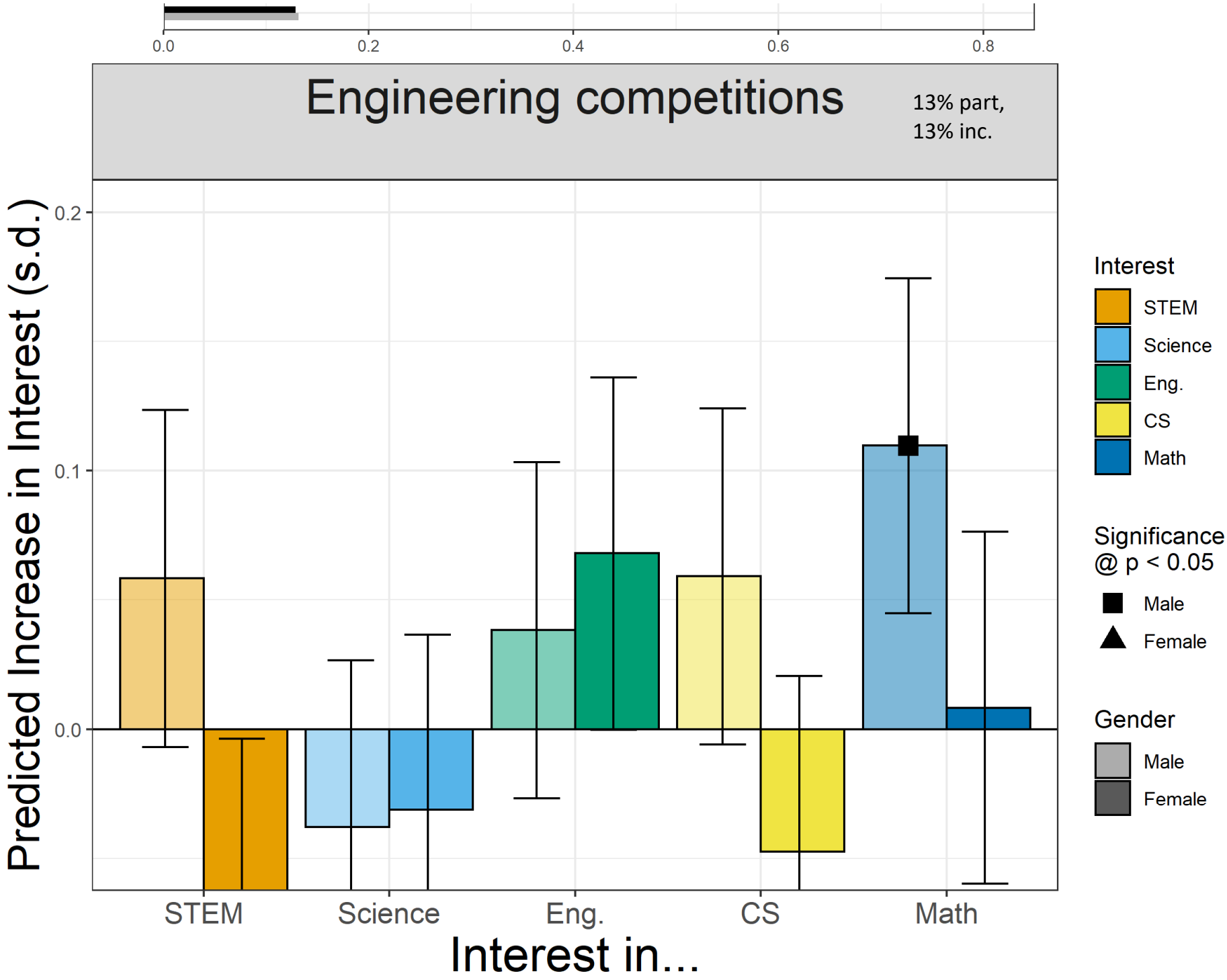

0.0
0.2
0.4
0.6
0.8
Attending lectures
25% part,
30% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

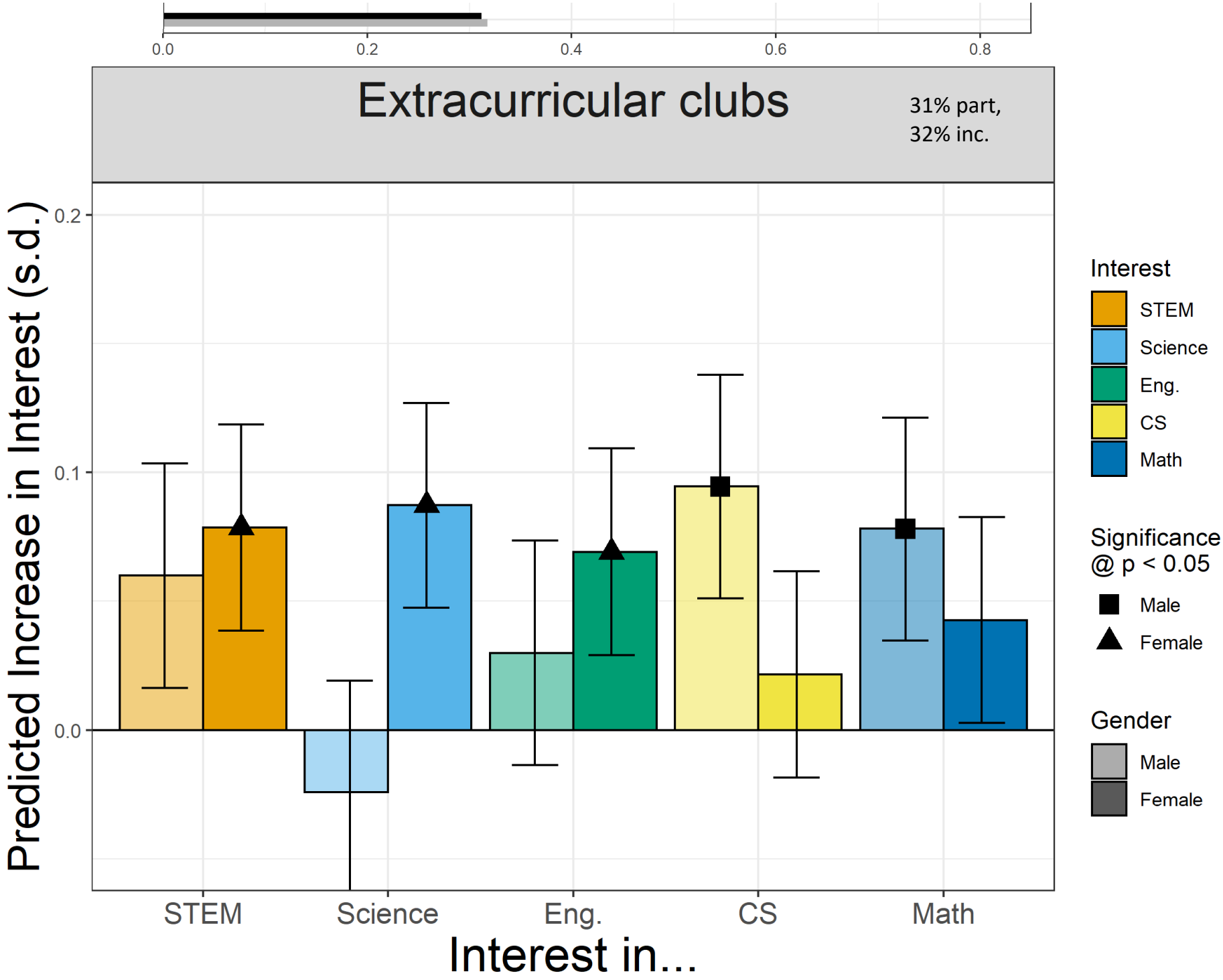

0.0
0.2
0.4
0.6
0.8
Building/constructing STEM models
3.9% part,
6.0% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

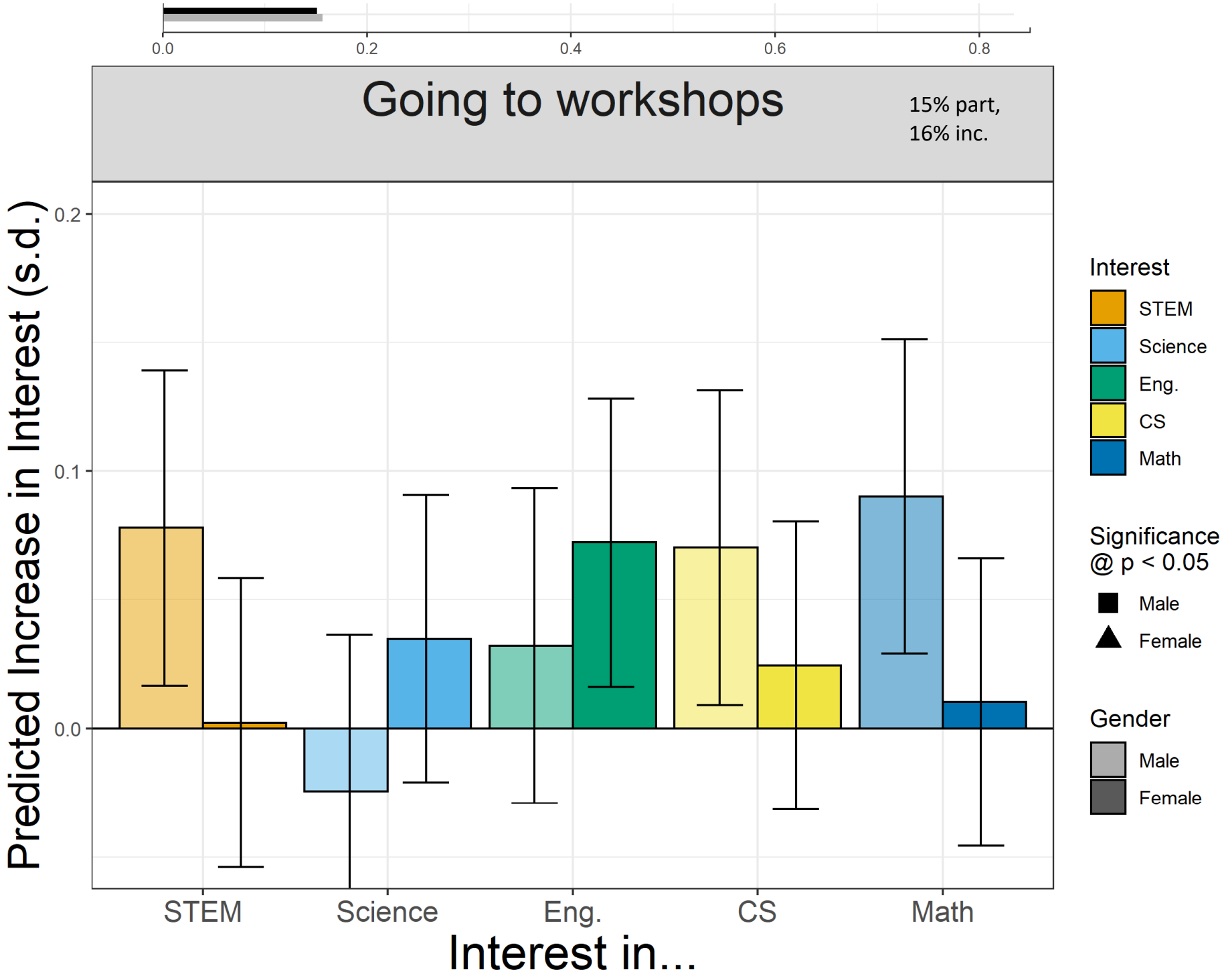

0.0
0.2
0.4
0.6
0.8
'Citizen science'
13% part,
8.9% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

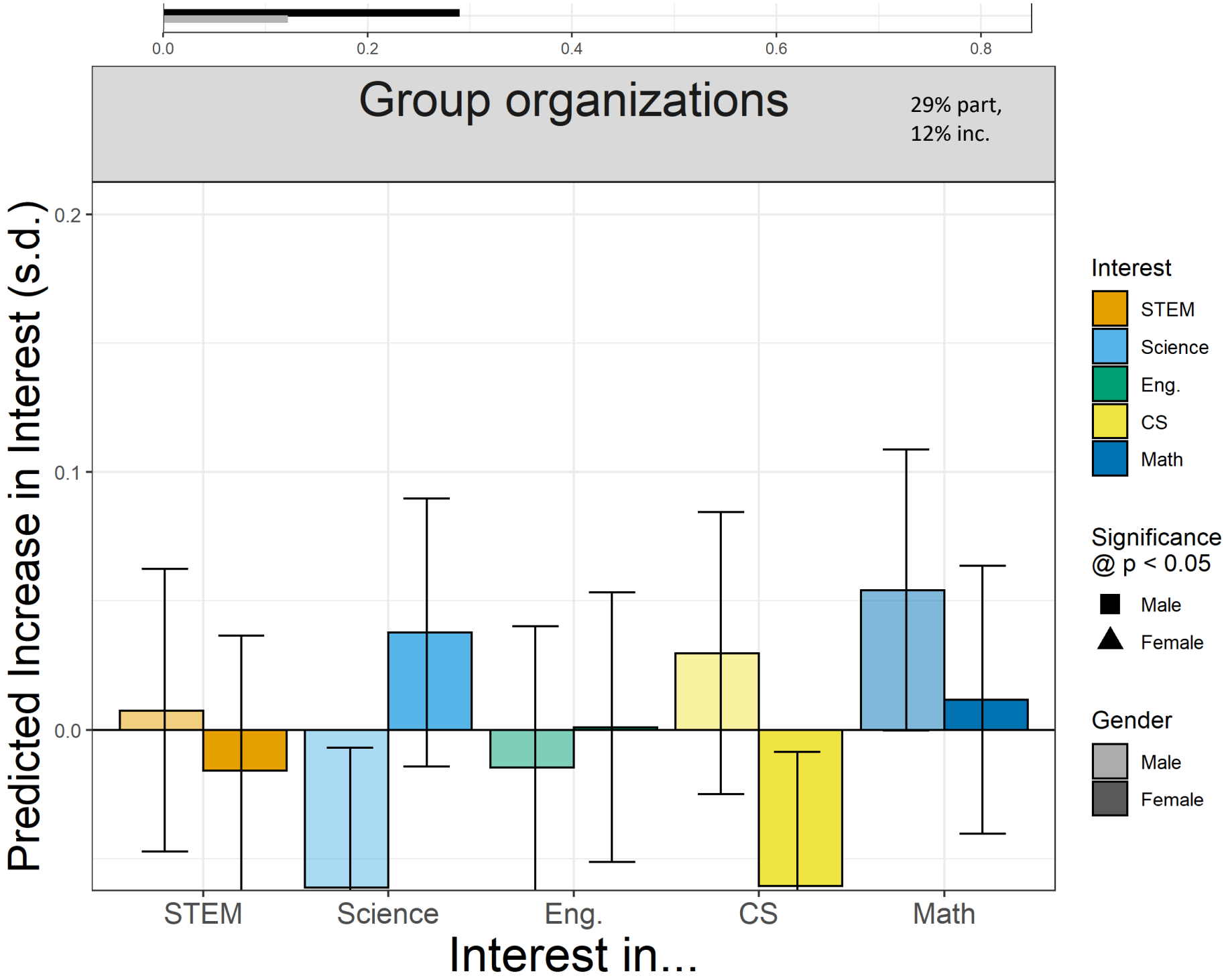

0.0
0.2
0.4
0.6
0.8
Computer science/
IT competitions
12% part,
11% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

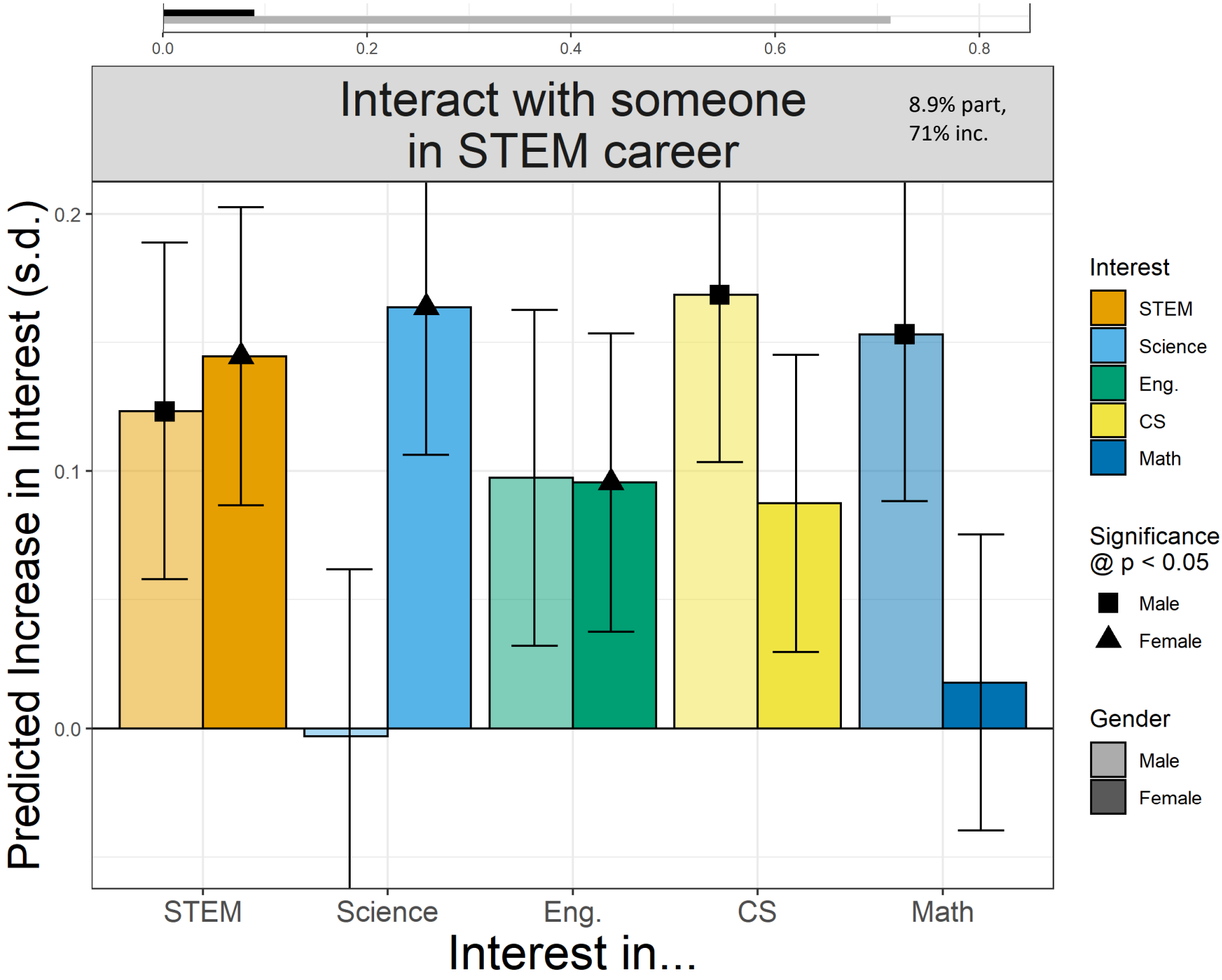

0.0
0.2
0.4
0.6
0.8
Designing and carrying out own STEM project
4.0% part, 73% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

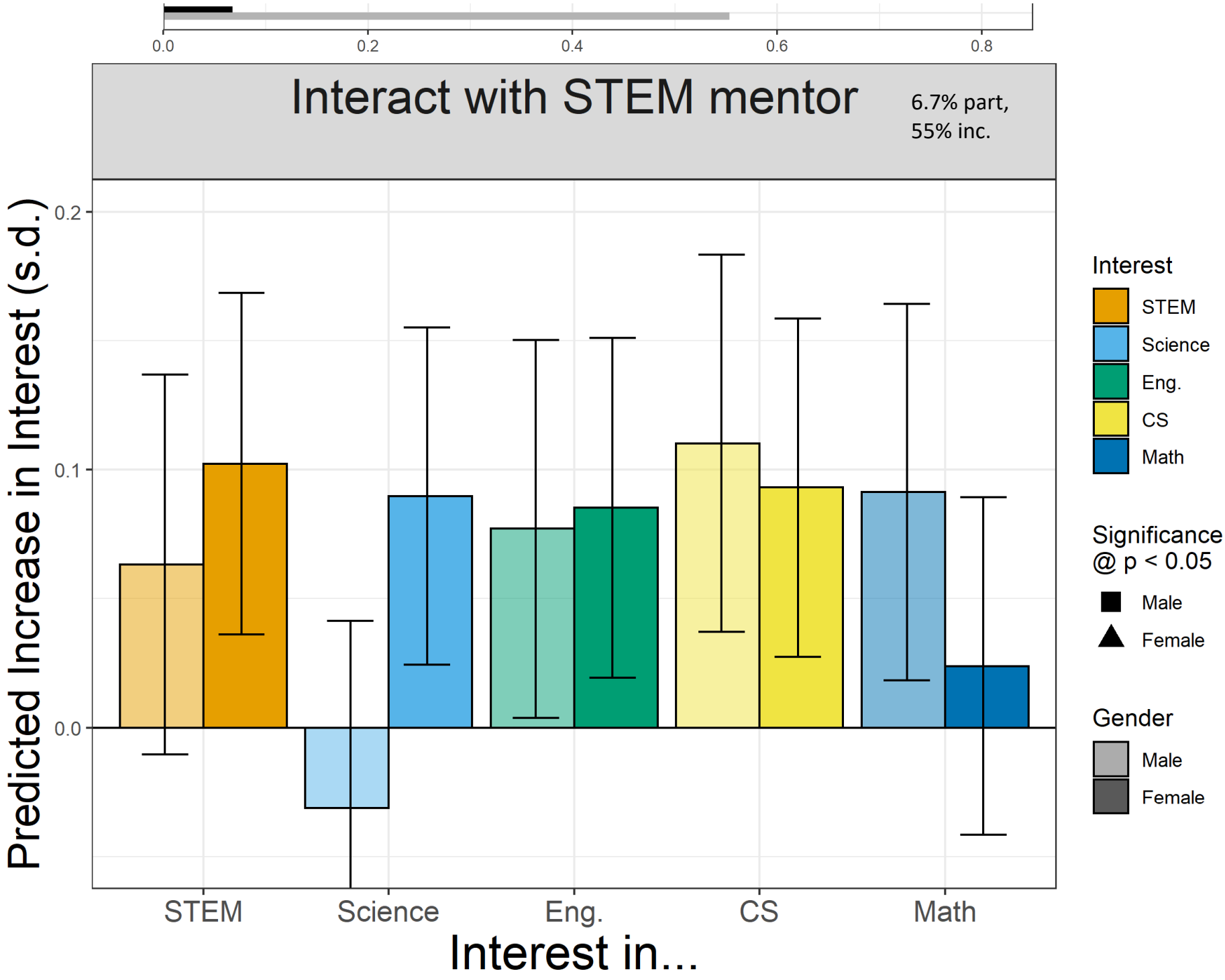

0.0
0.2
0.4
0.6
0.8
Engineering competitions
13% part,
13% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

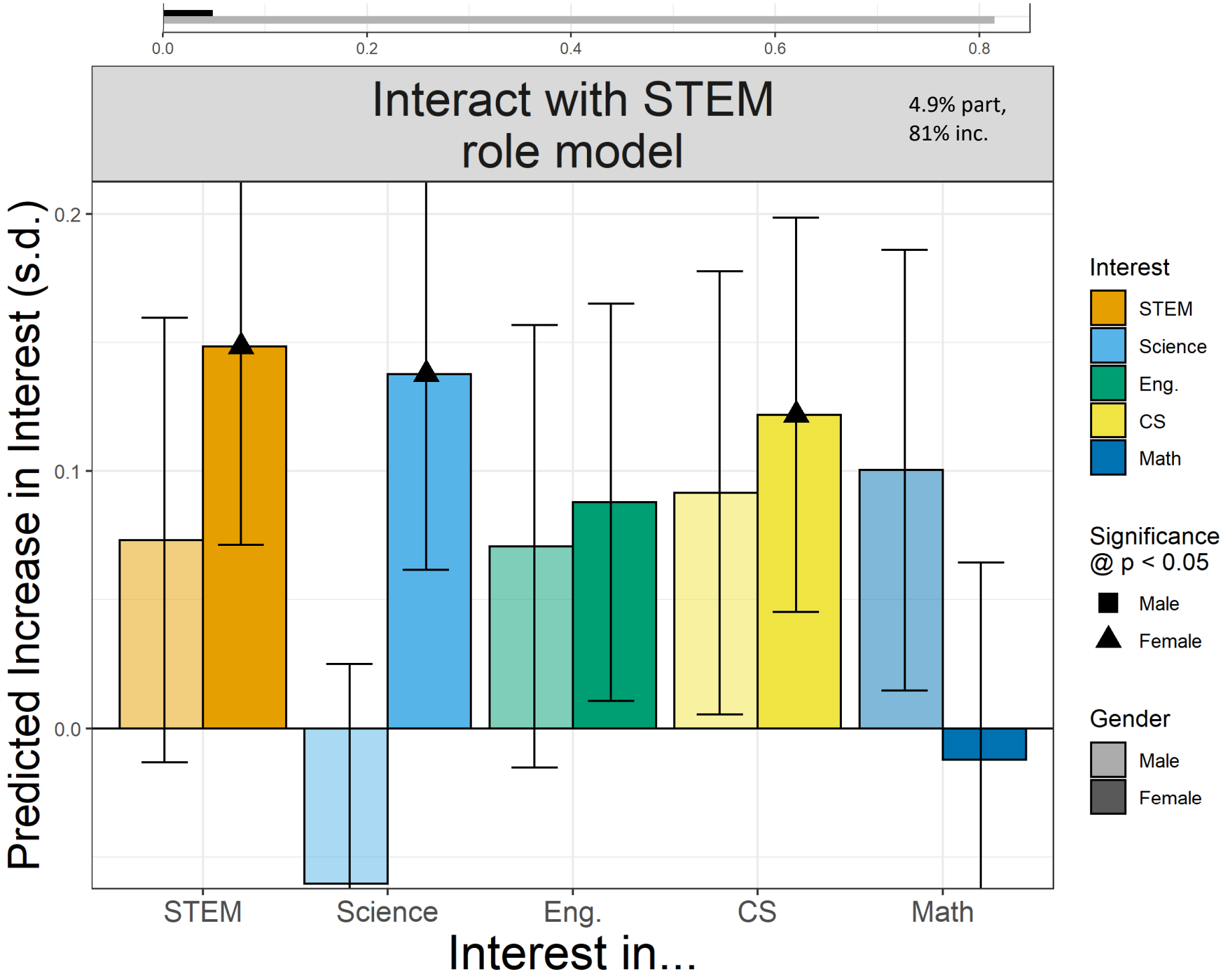

0.0
0.2
0.4
0.6
0.8
Extracurricular clubs
31% part,
32% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Going to workshops
15% part,
16% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Group organizations
29% part,
12% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Interact with someone in STEM career
8.9% part,
71% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Interact with STEM mentor
6.7% part,
55% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
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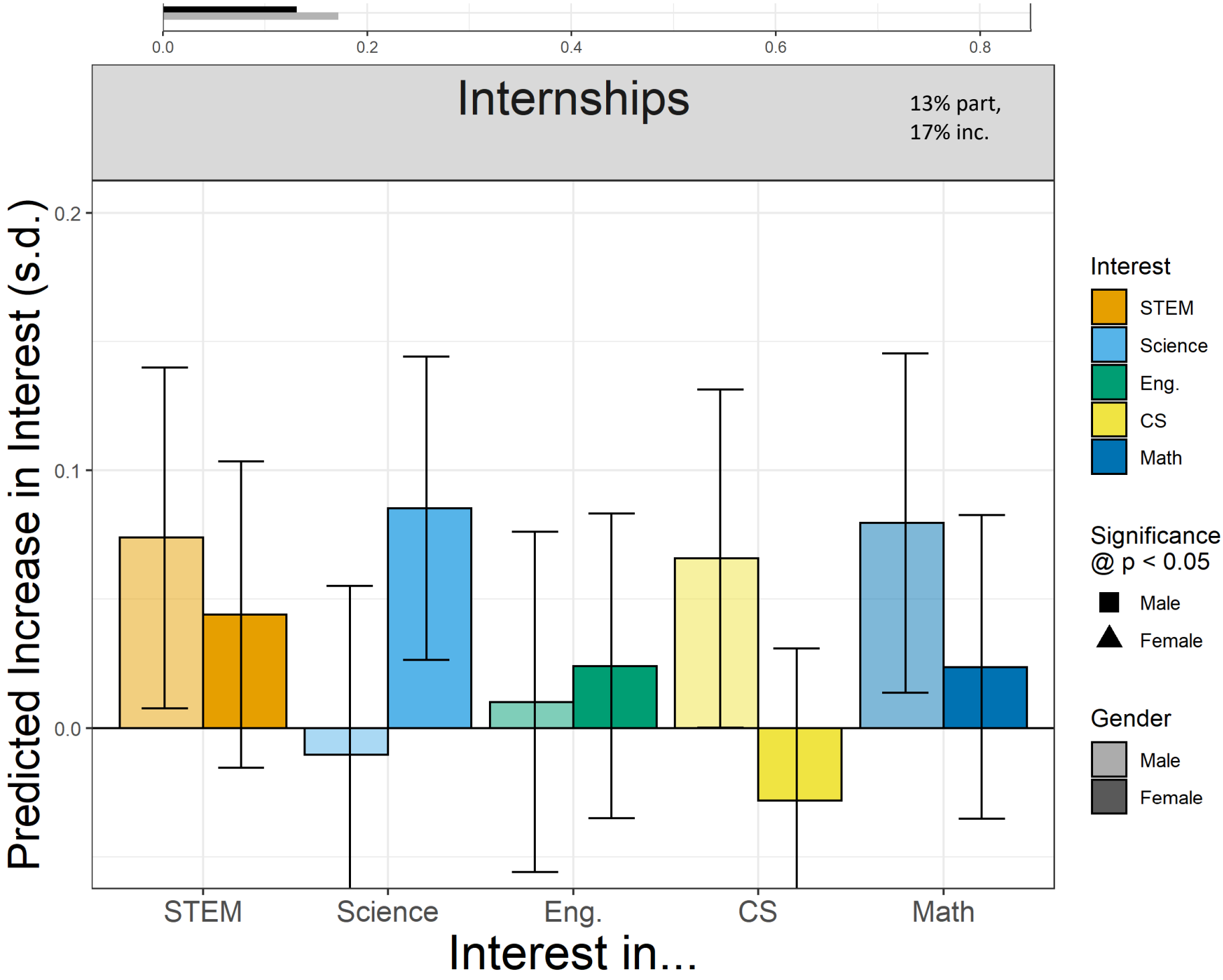
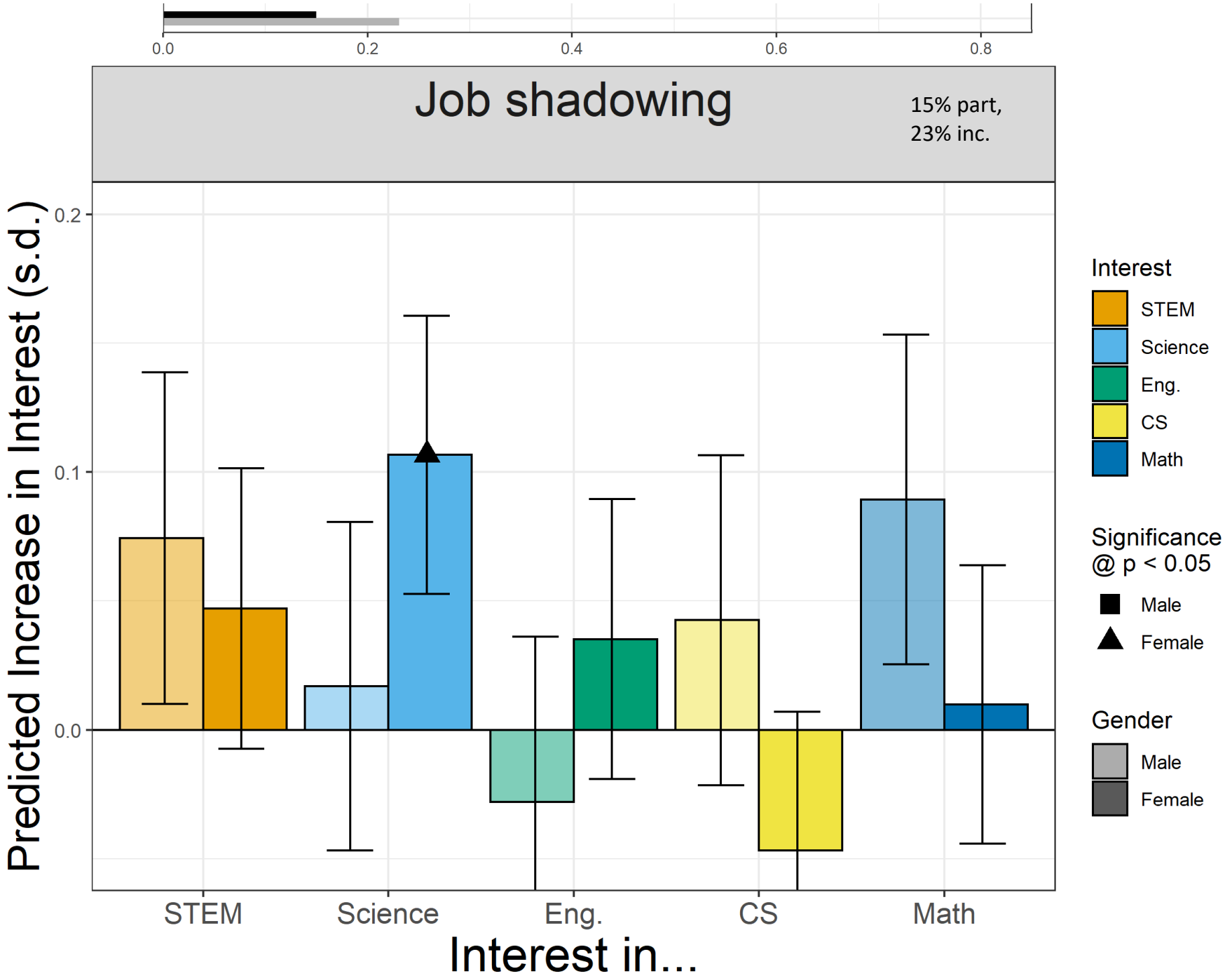
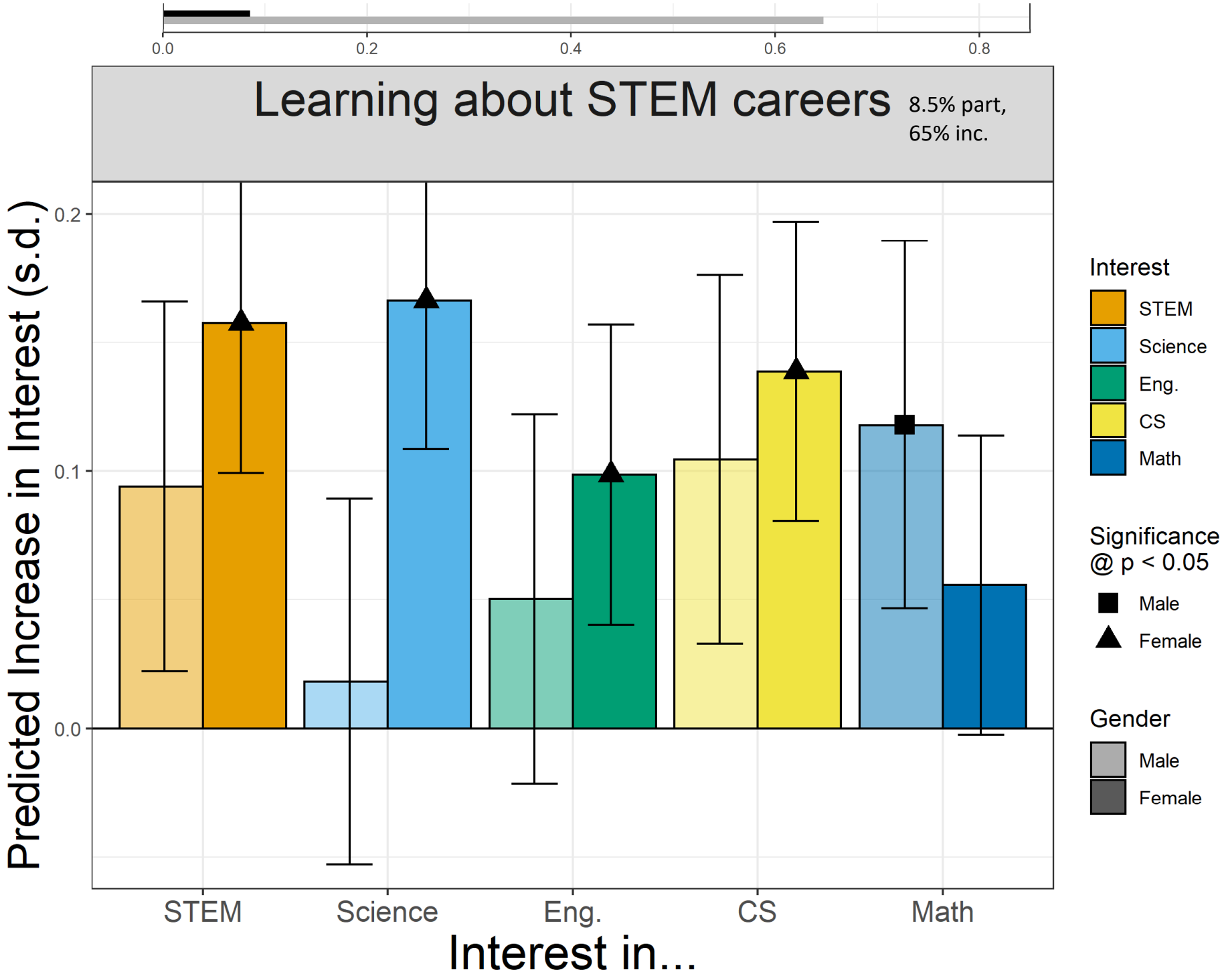
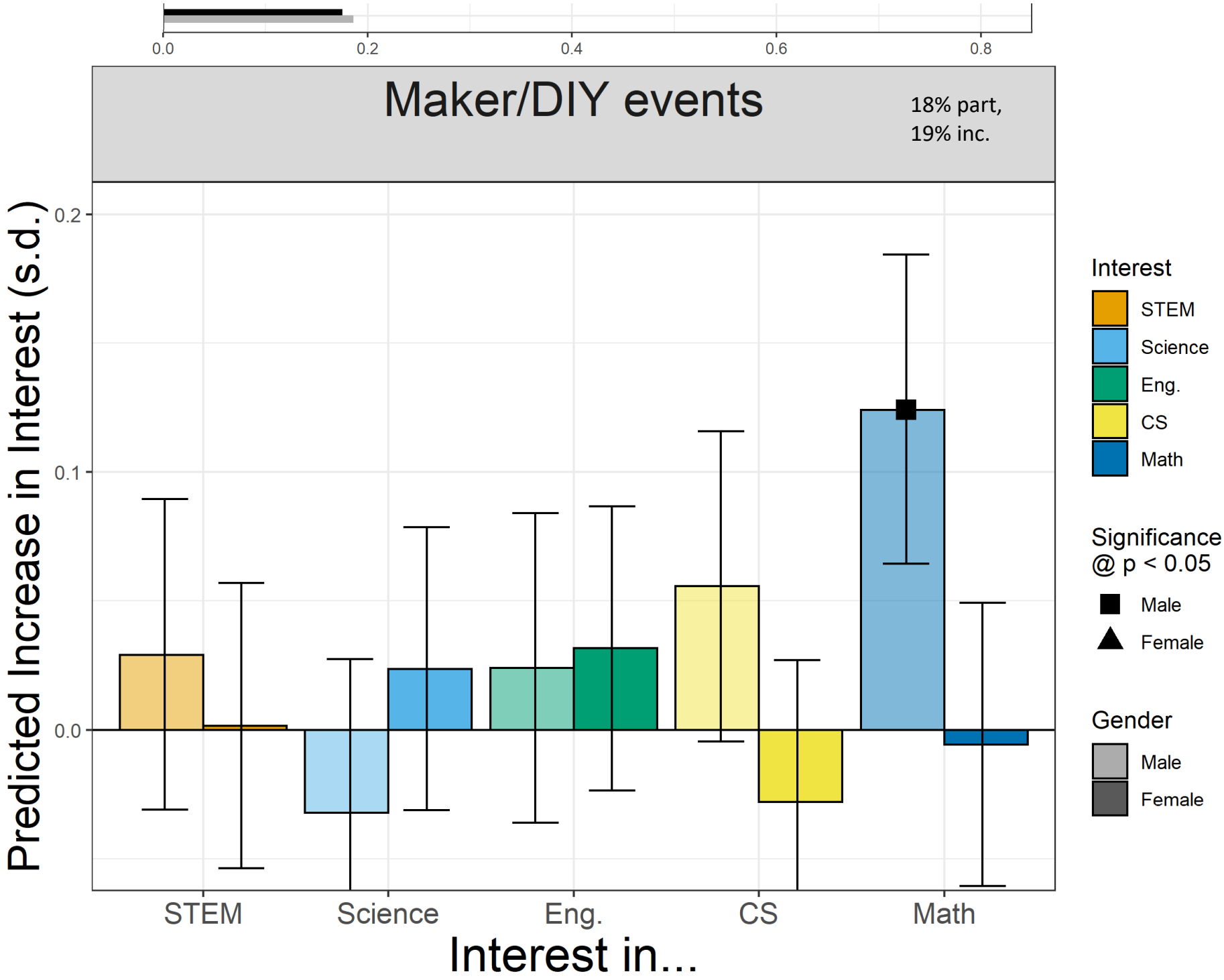
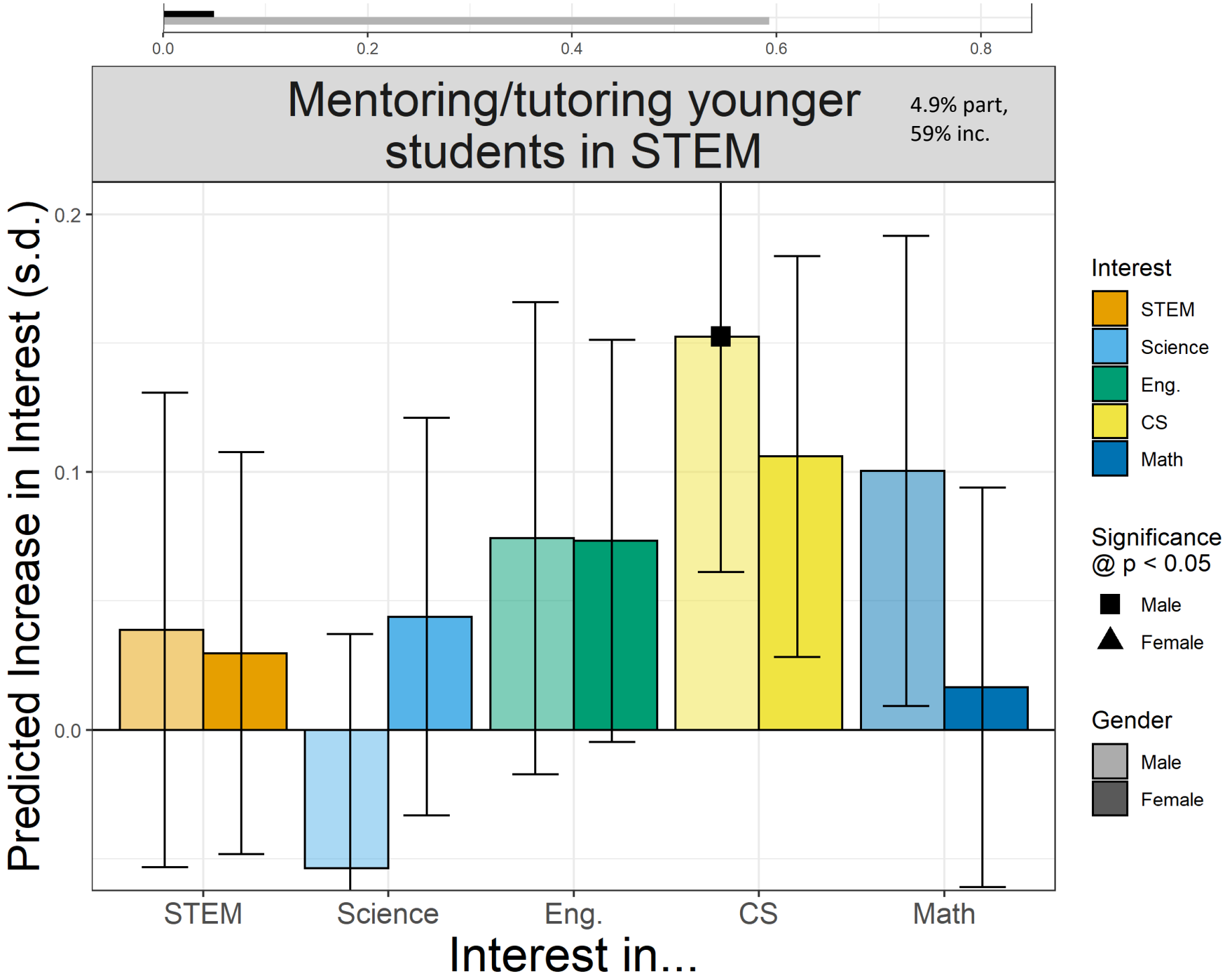
0.4
0.6
0.8
Interact with STEM role model
4.9% part, 81% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

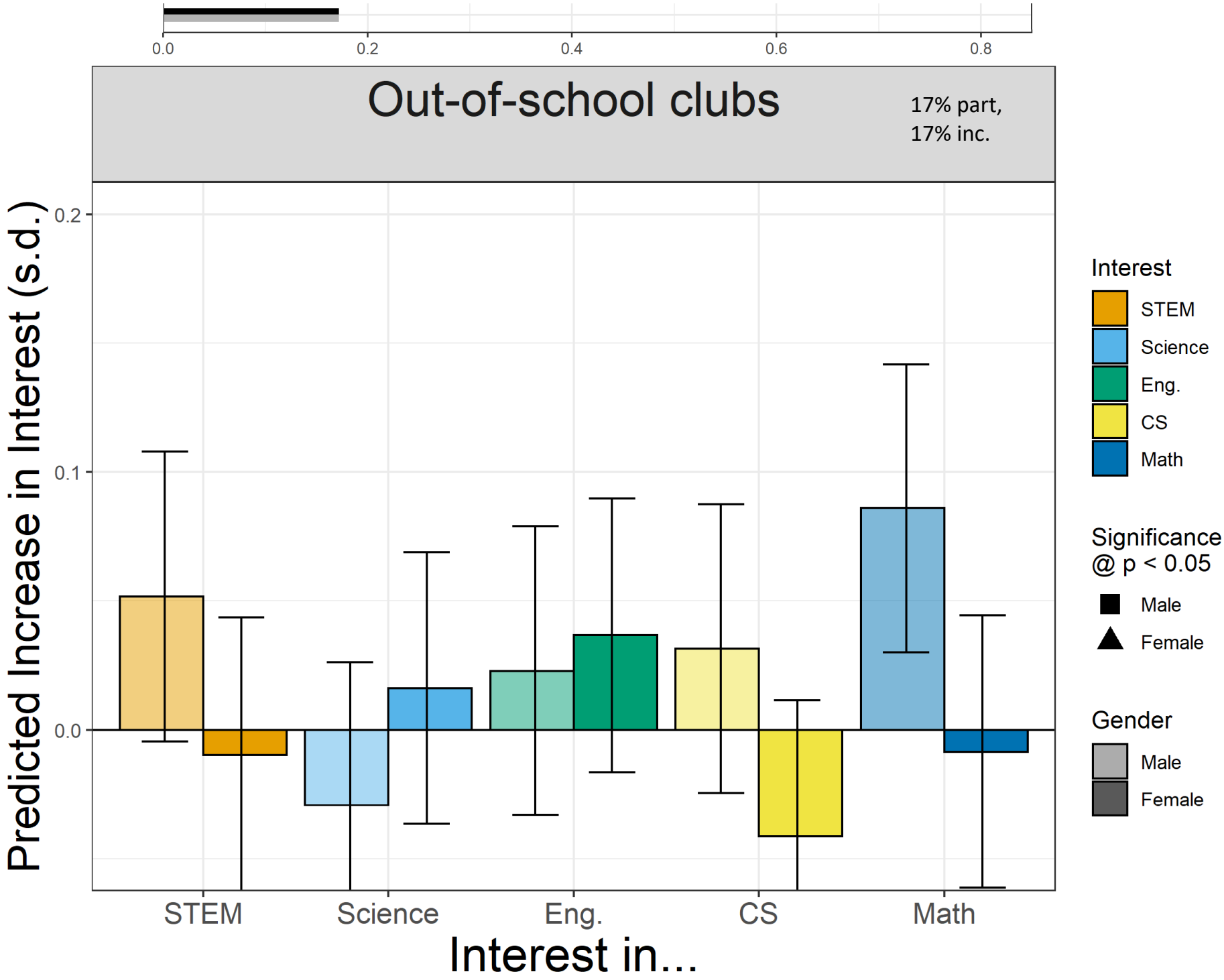

0.0
0.2
0.4
0.6
0.8
Internships
13% part,
17% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

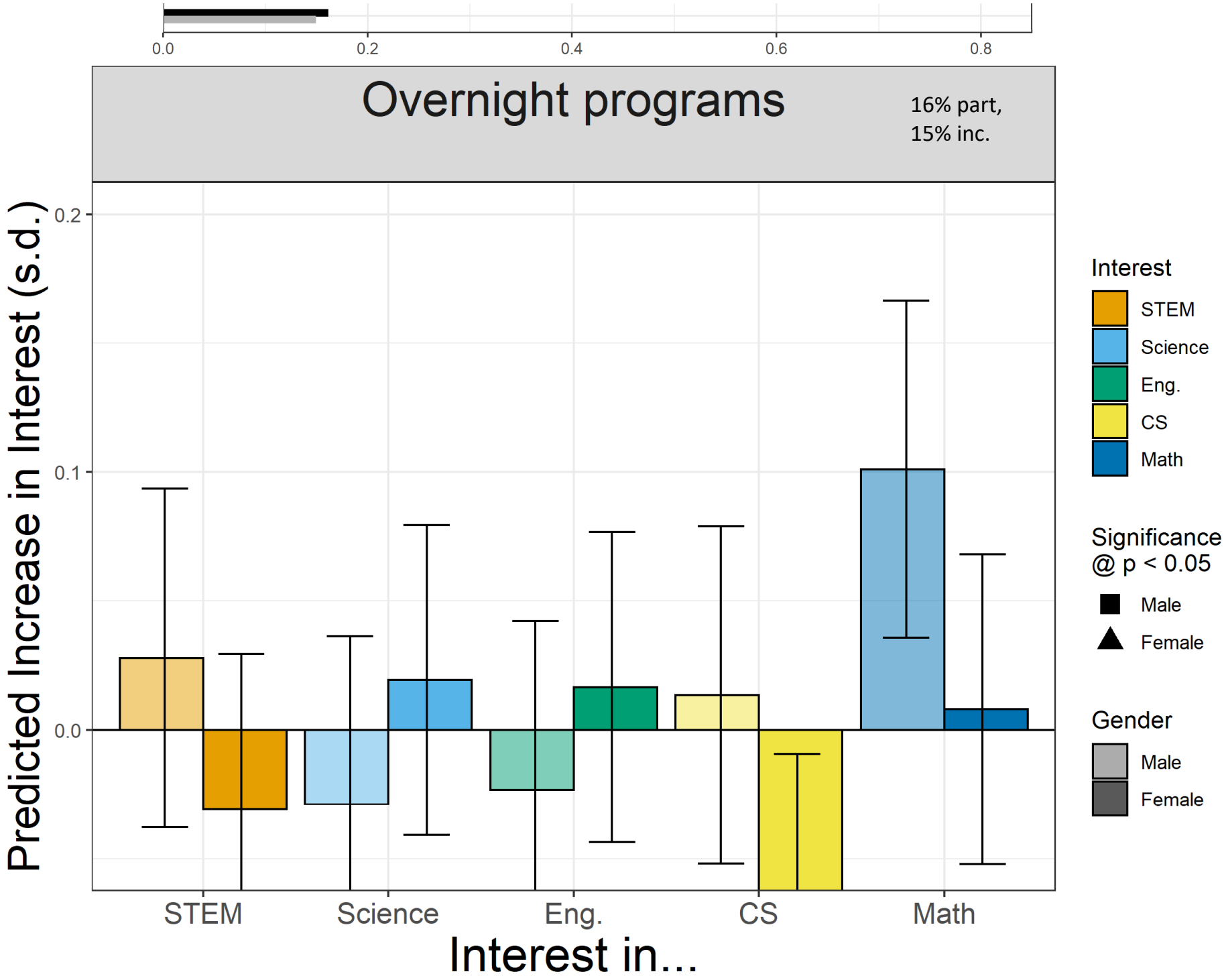

0.0
0.2
0.4
0.6
0.8
Job shadowing
15% part,
23% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

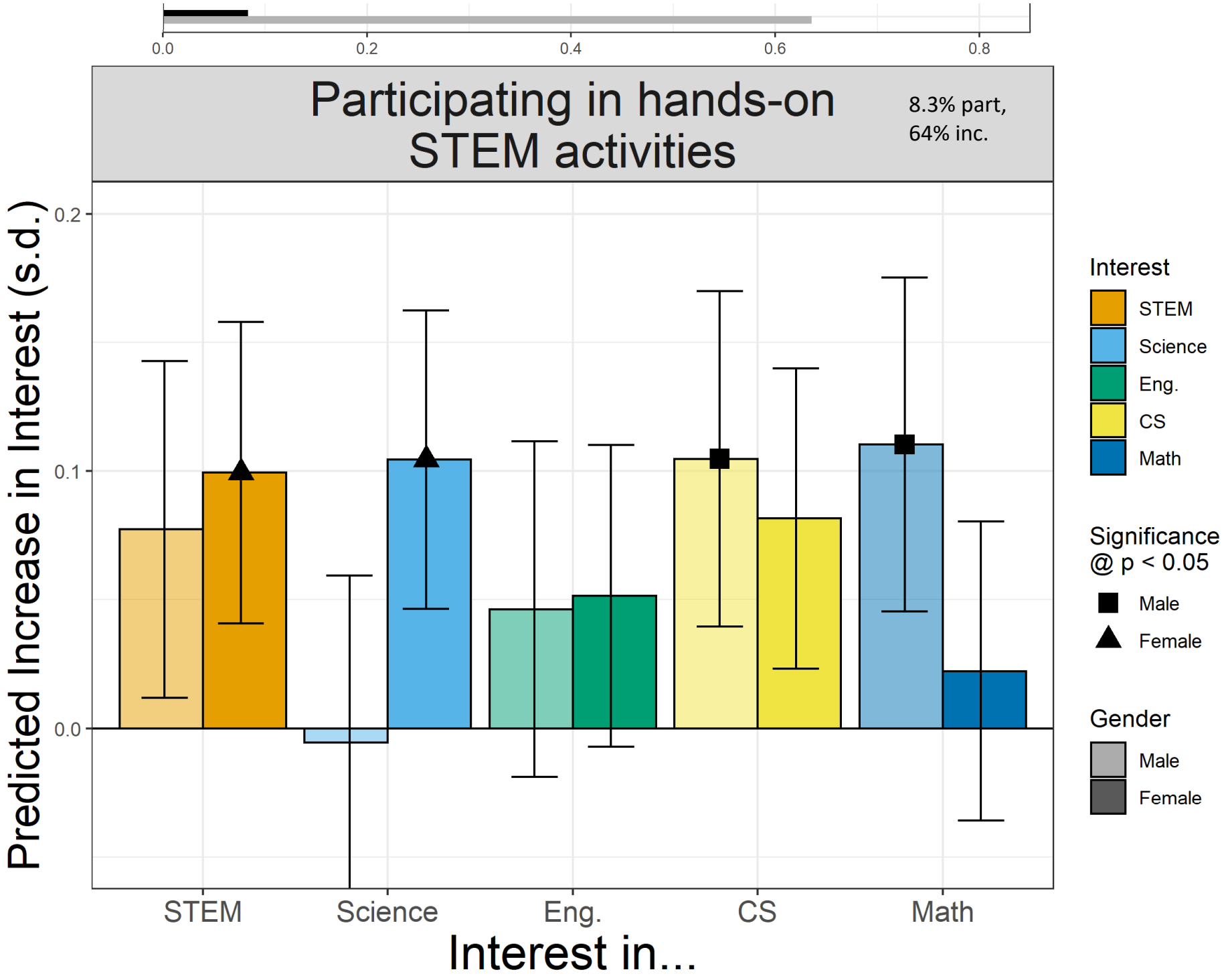

0.0
0.2
0.4
0.6
0.8
Learning about STEM careers
8.5% part,
65% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

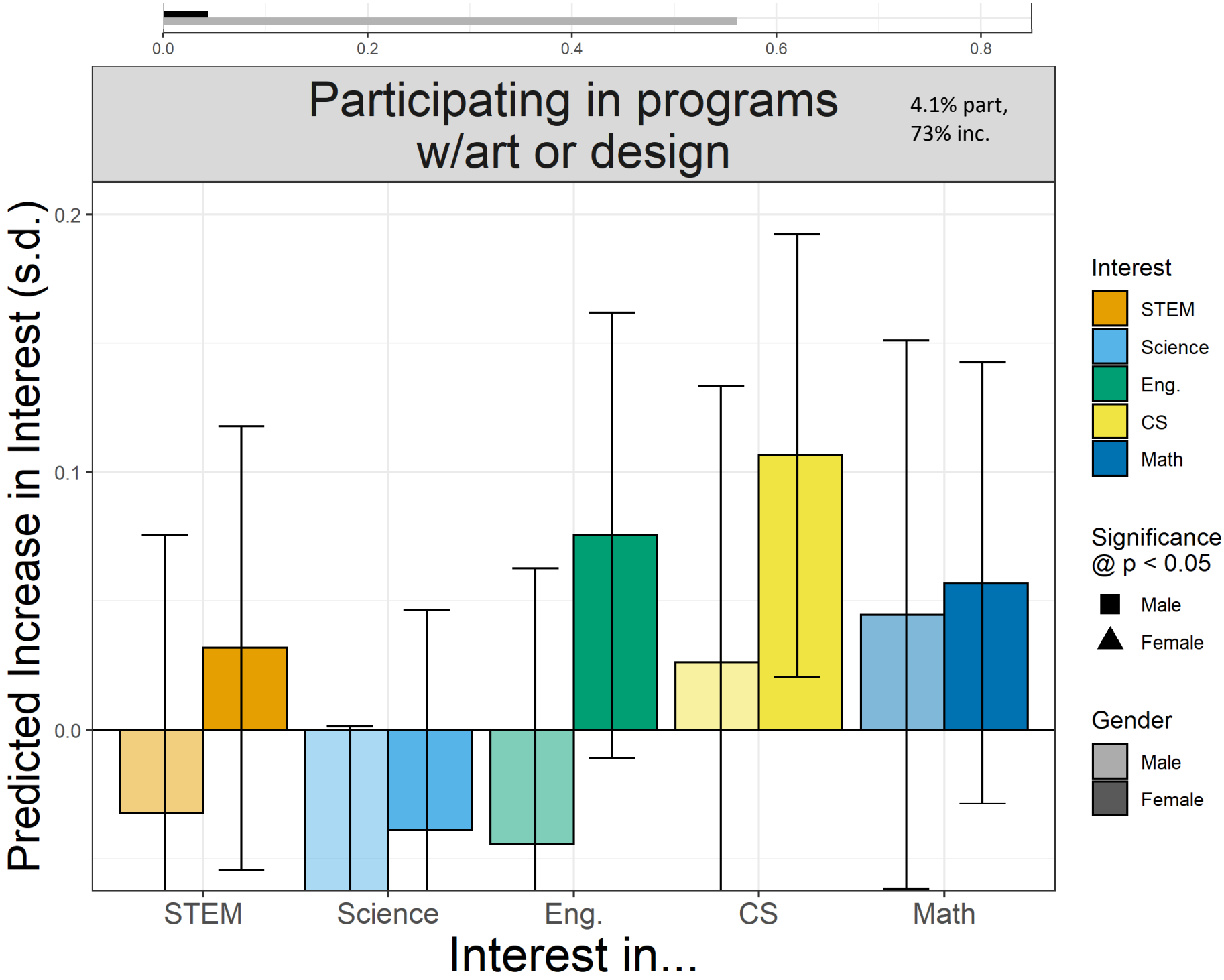

0.0
0.2
0.4
0.6
0.8
Maker/DIY events
18% part,
19% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

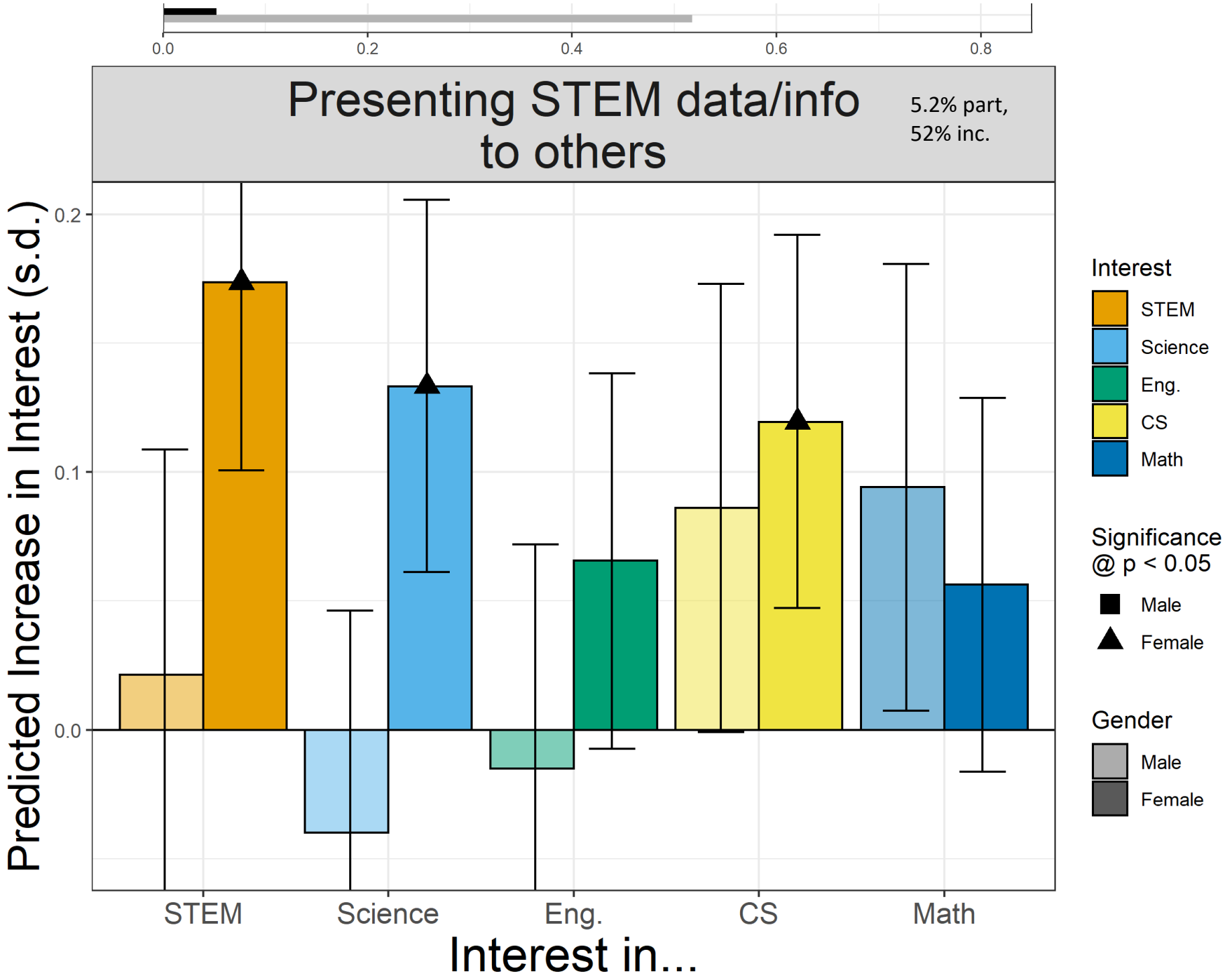

0.0
0.2
0.4
0.6
0.8
Mentoring/tutoring younger students in STEM
4.9% part,
59% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

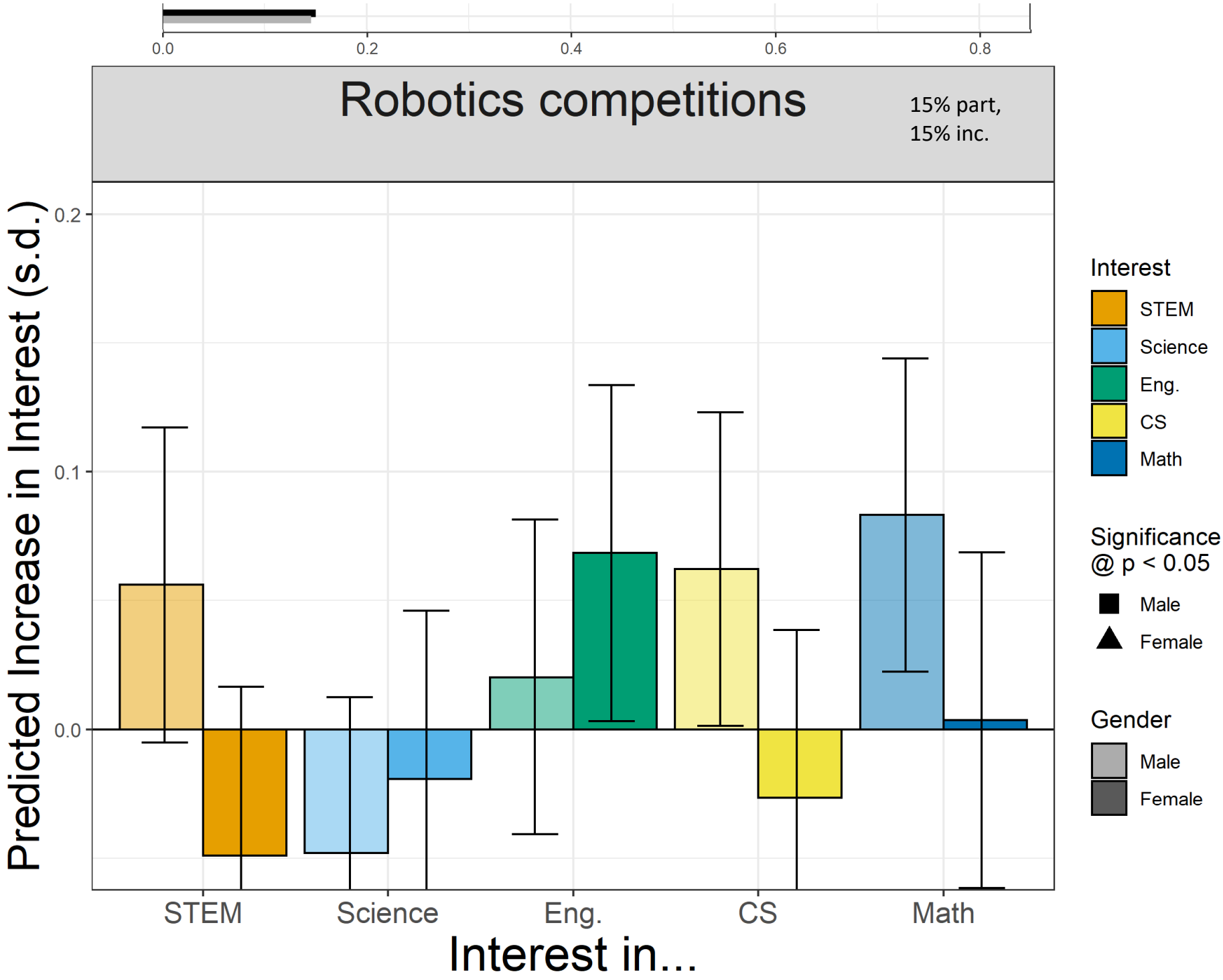

0.0
0.2
0.4
0.6
0.8
Out-of-school clubs
17% part,
17% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

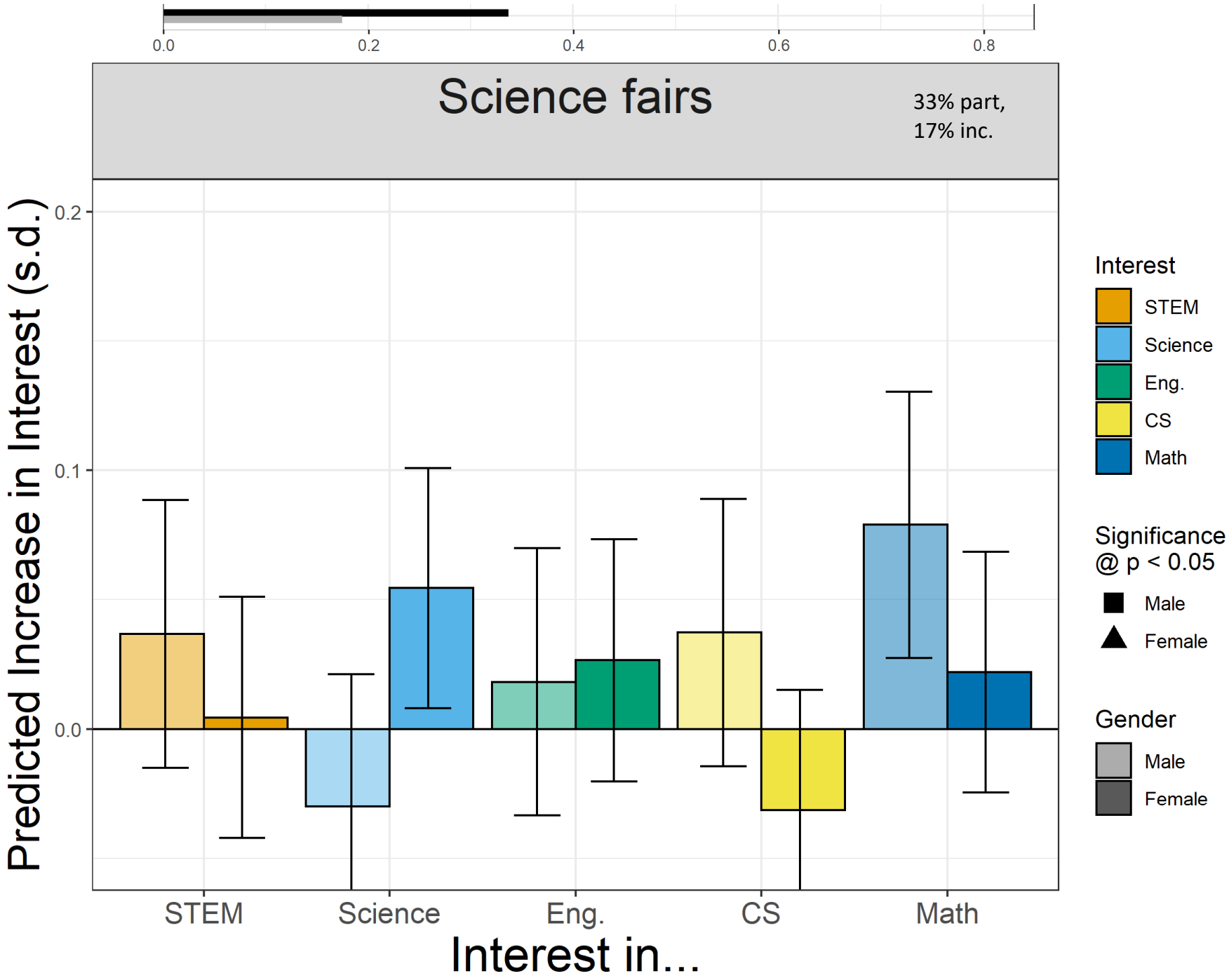

0.0
0.2
0.4
0.6
0.8
Overnight programs
16% part,
15% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

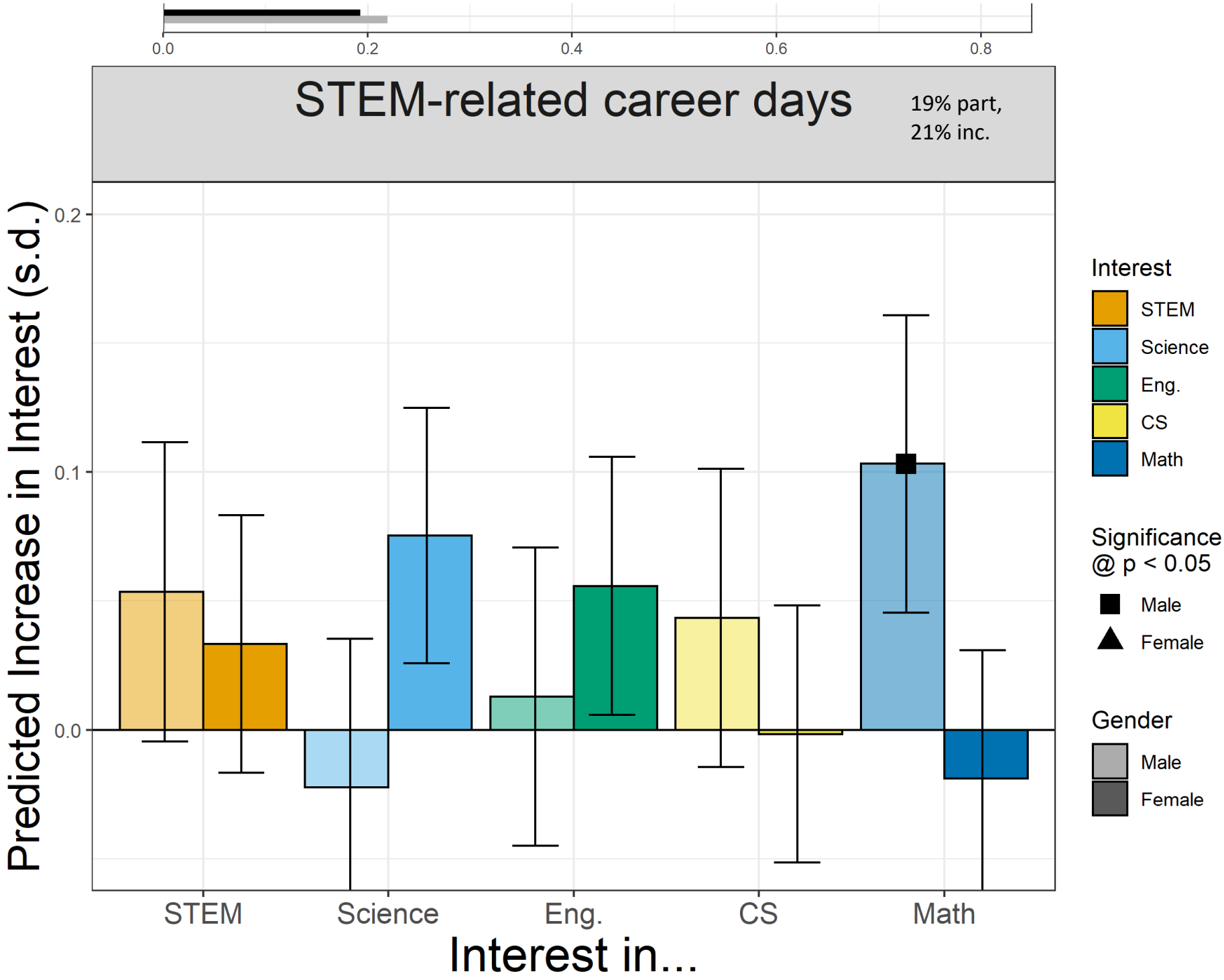

0.0
0.2
0.4
0.6
0.8
Participating in hands-on STEM activities
8.3% part, 64% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

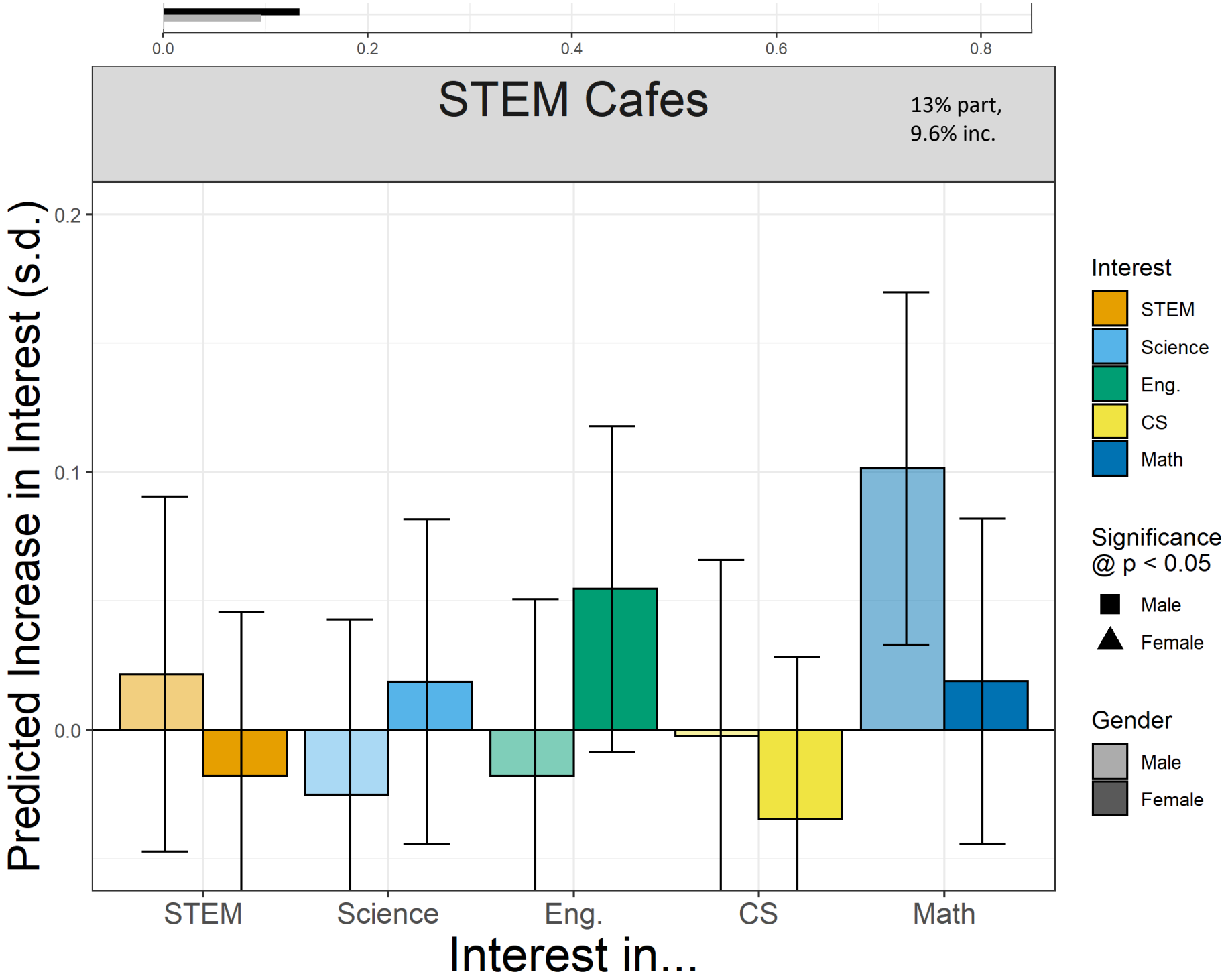

0.0
0.2
0.4
0.6
0.8
Participating in programs w/art or design
4.1% part,
73% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

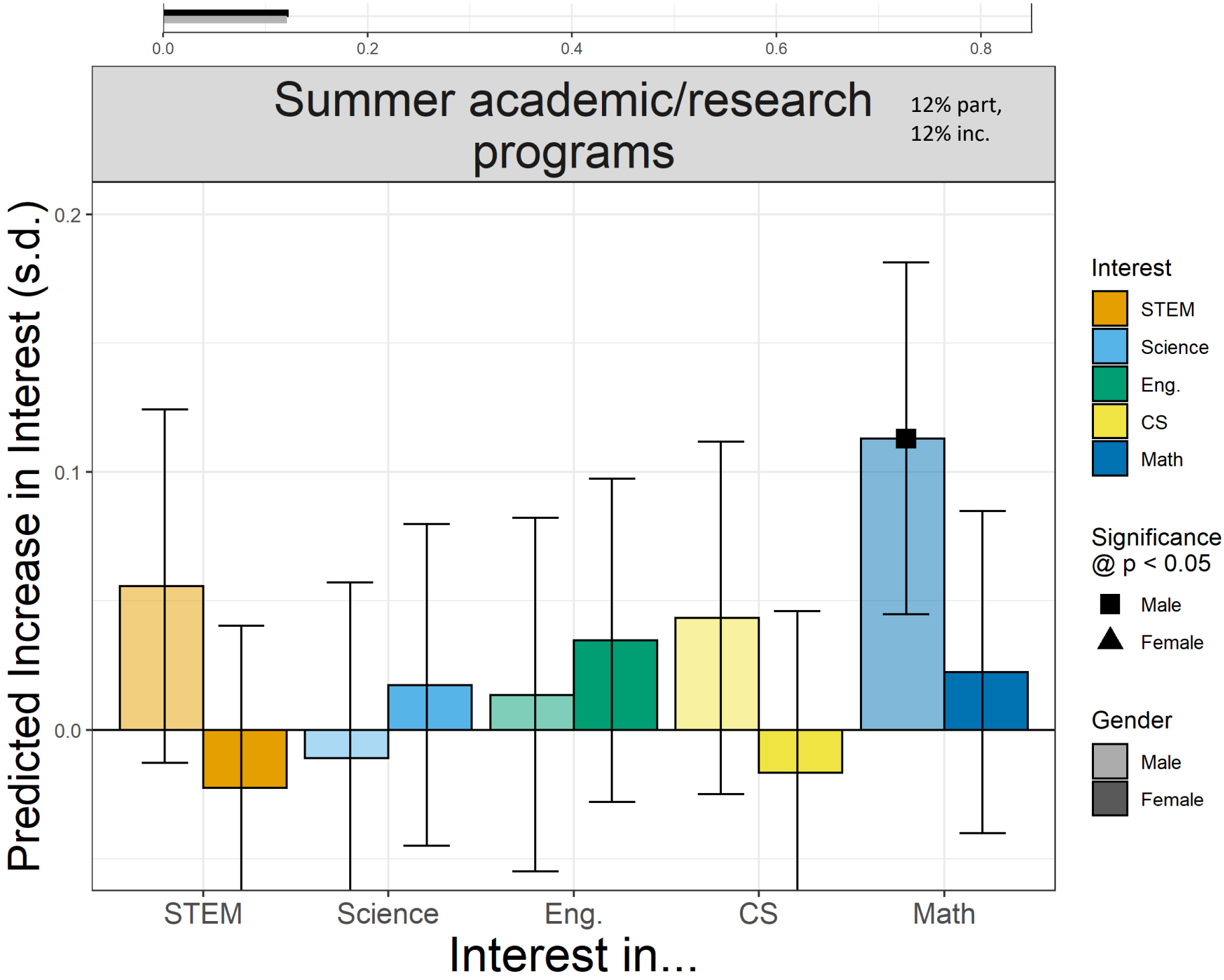

0.0
0.2
0.4
0.6
0.8
Presenting STEM data/info to others
5.2% part,
52% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

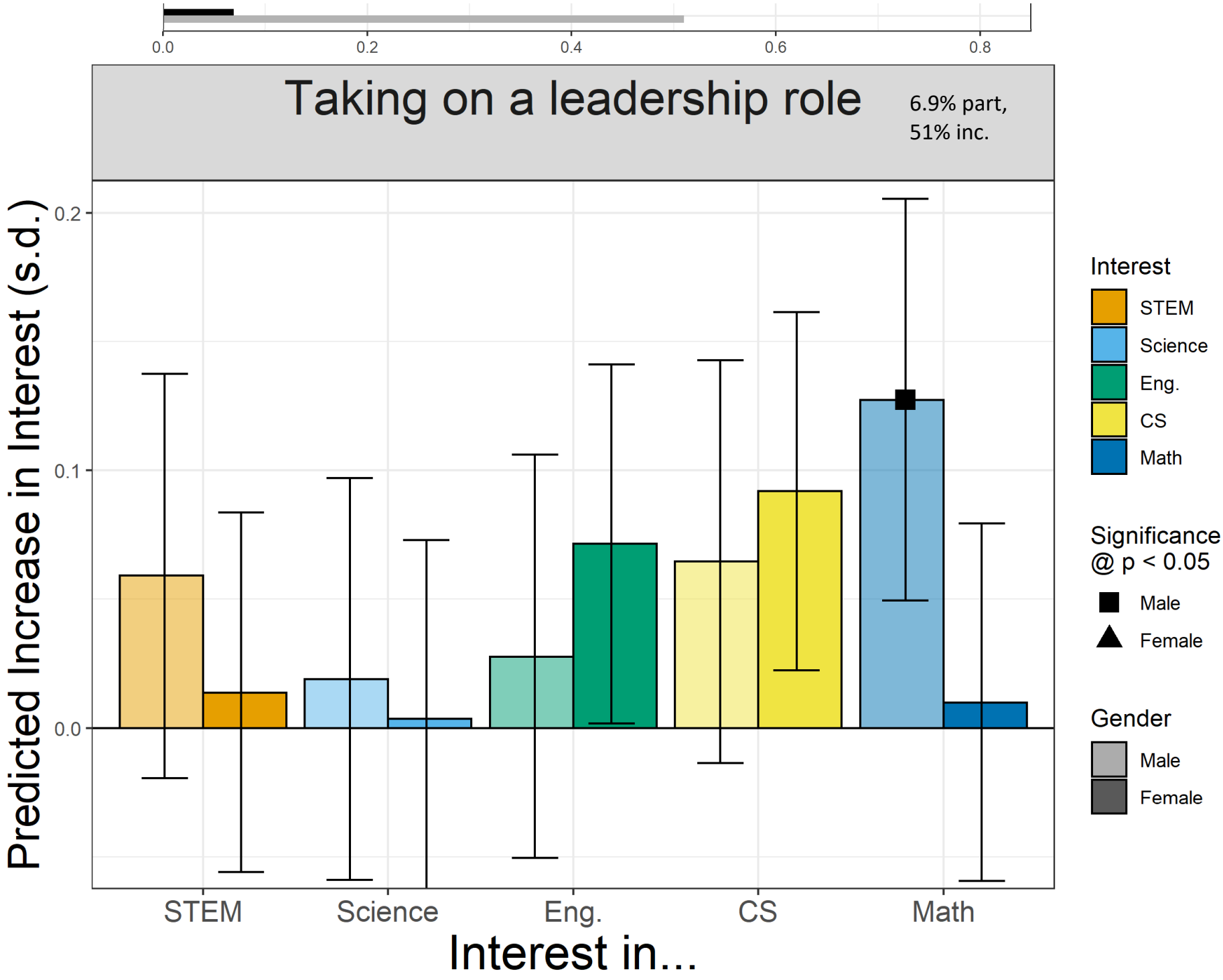

0.0
0.2
0.4
0.6
0.8
Robotics competitions
15% part,
15% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

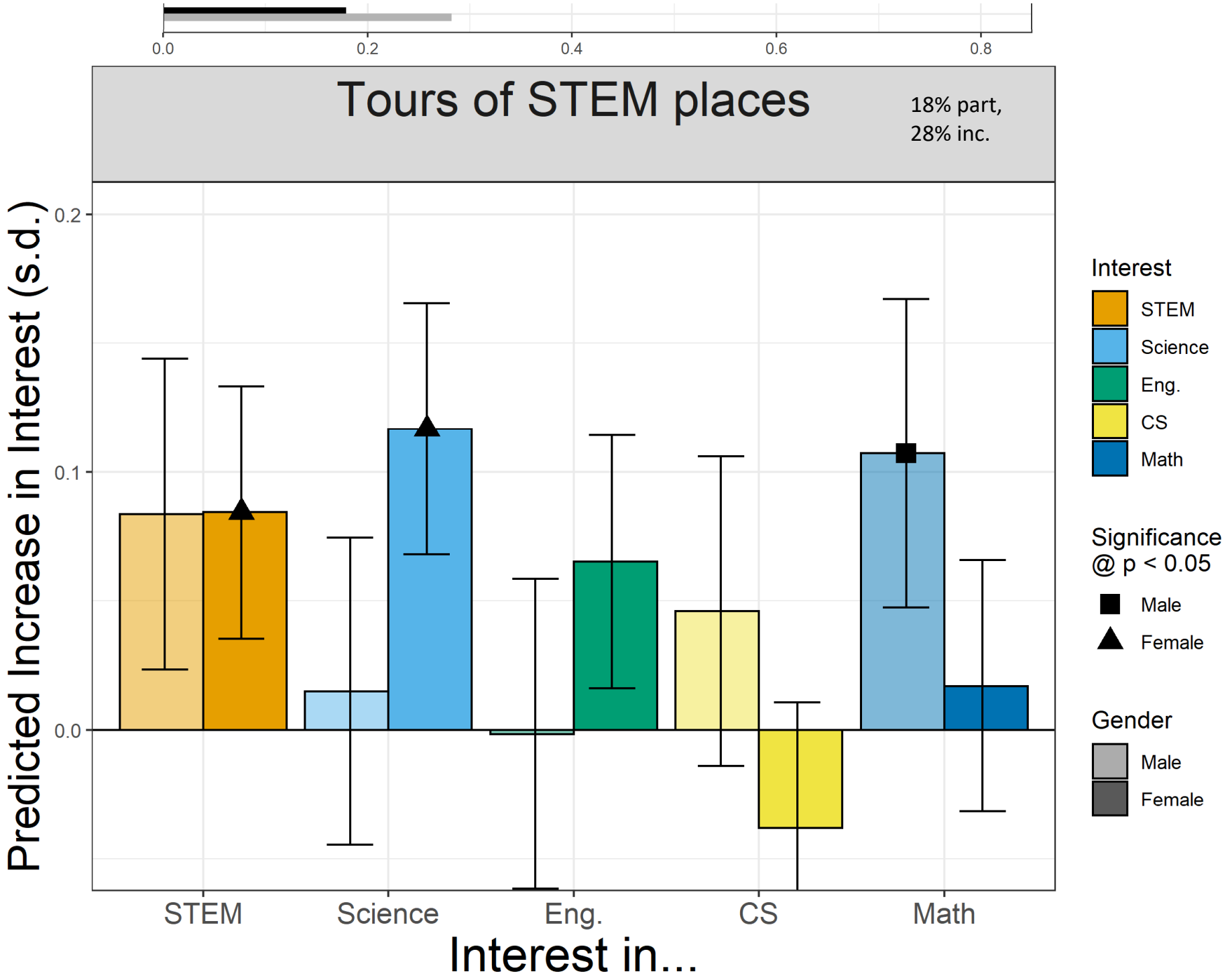

0.0
0.2
0.4
0.6
0.8
Science fairs
33% part,
17% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

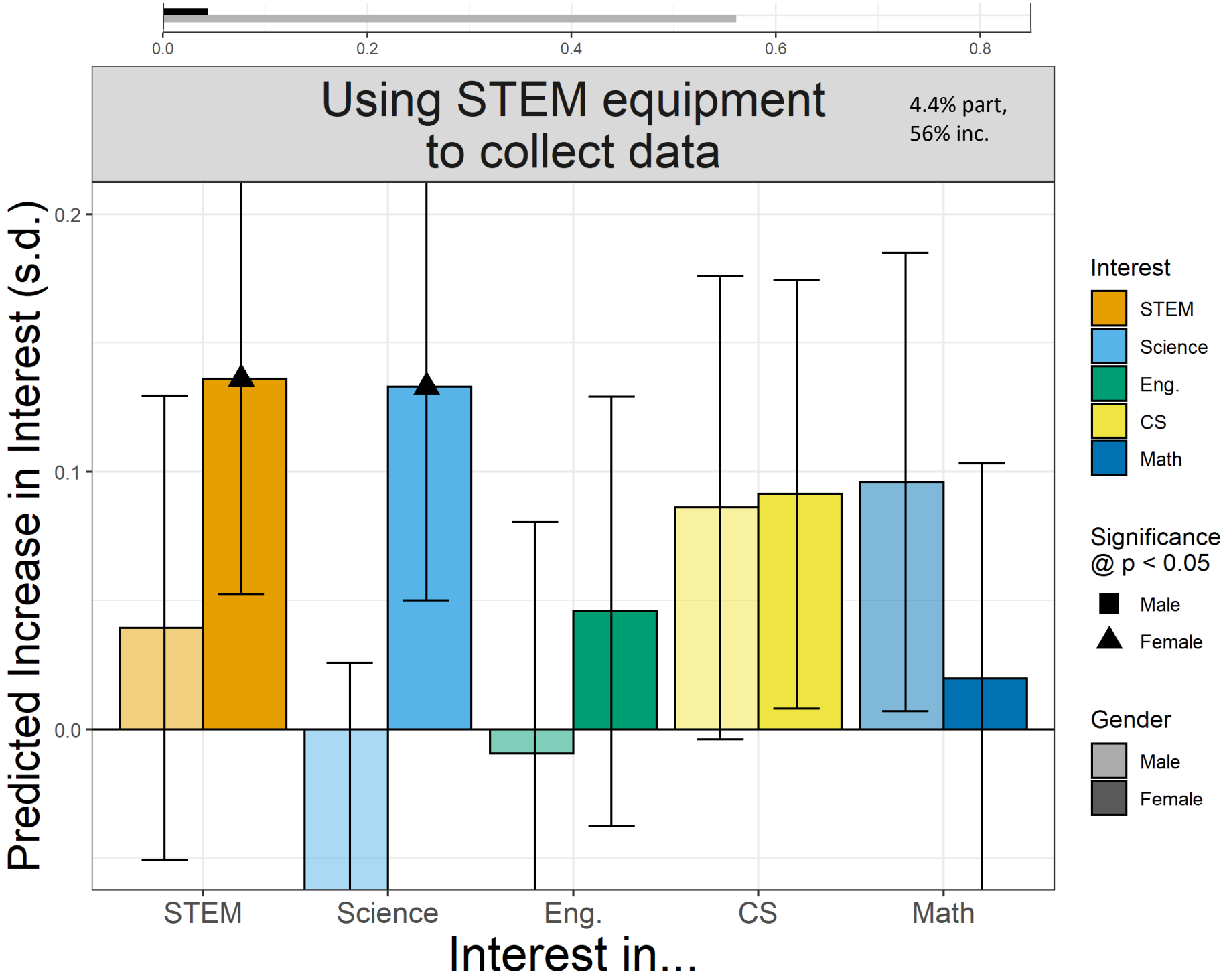

0.0
0.2
0.4
0.6
0.8
STEM-related career days
19% part,
21% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

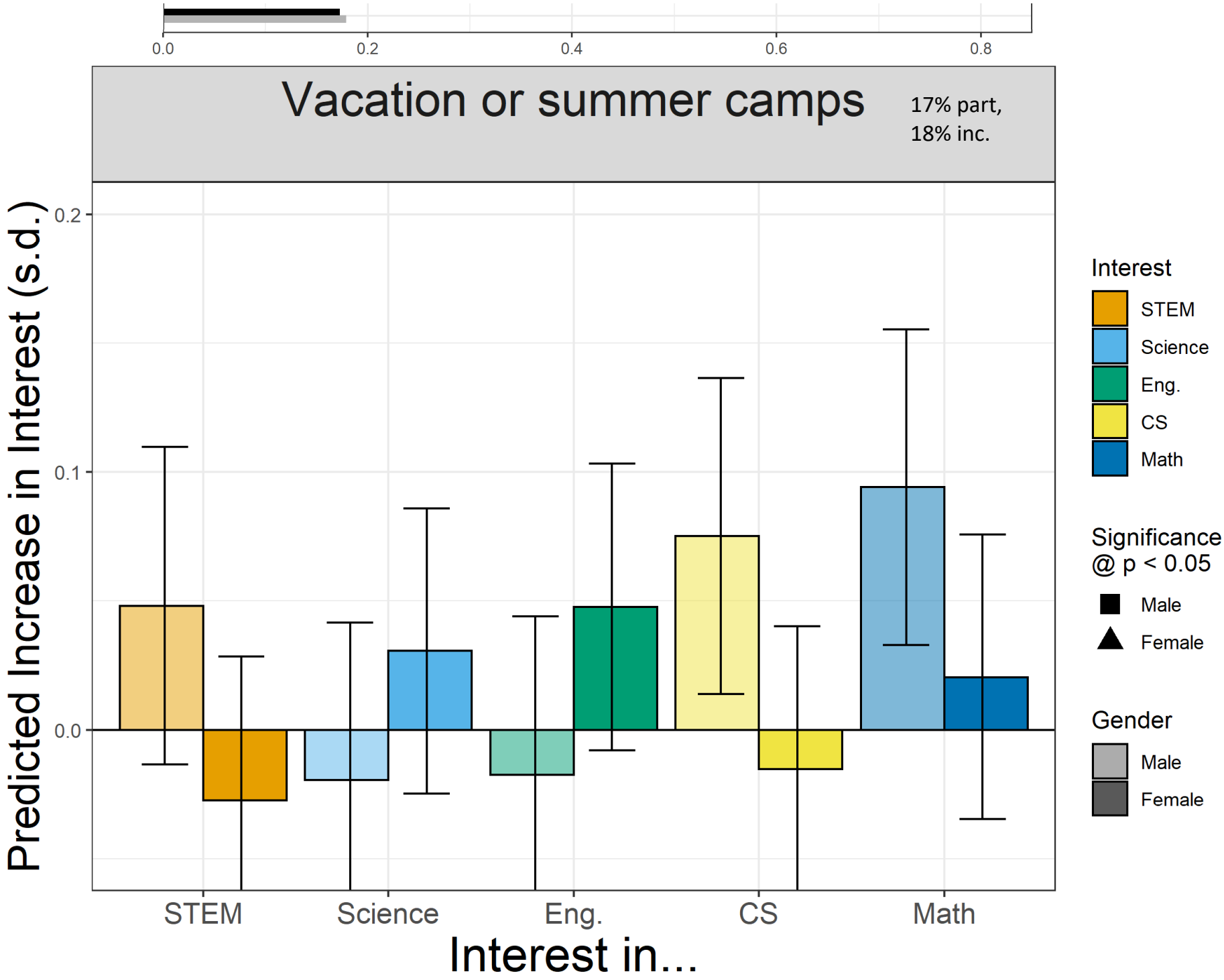

0.0
0.2
0.4
0.6
0.8
STEM Cafes
13% part,
9.6% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

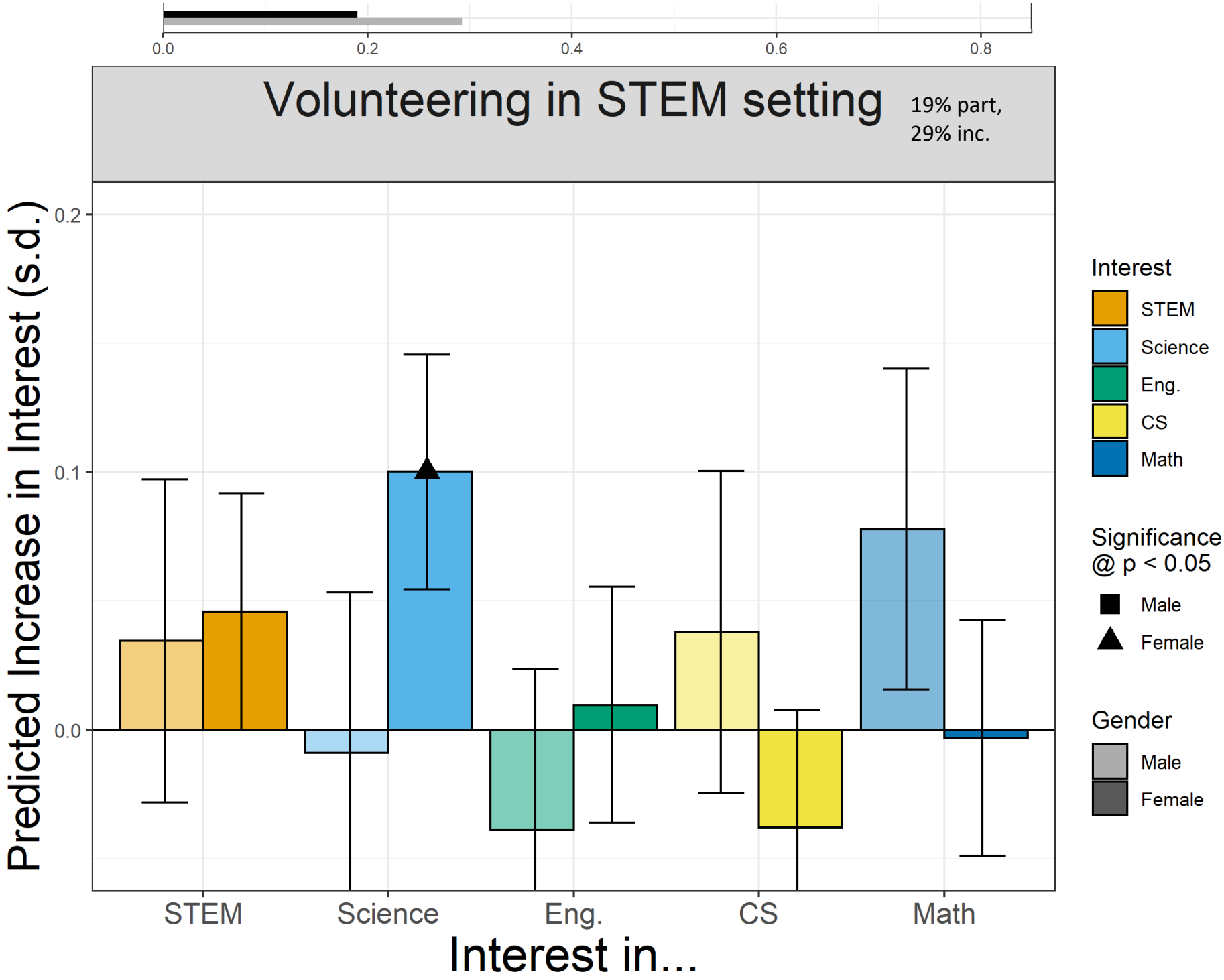

0.0
0.2
0.4
0.6
0.8
Summer academic/research programs
12% part,
12% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

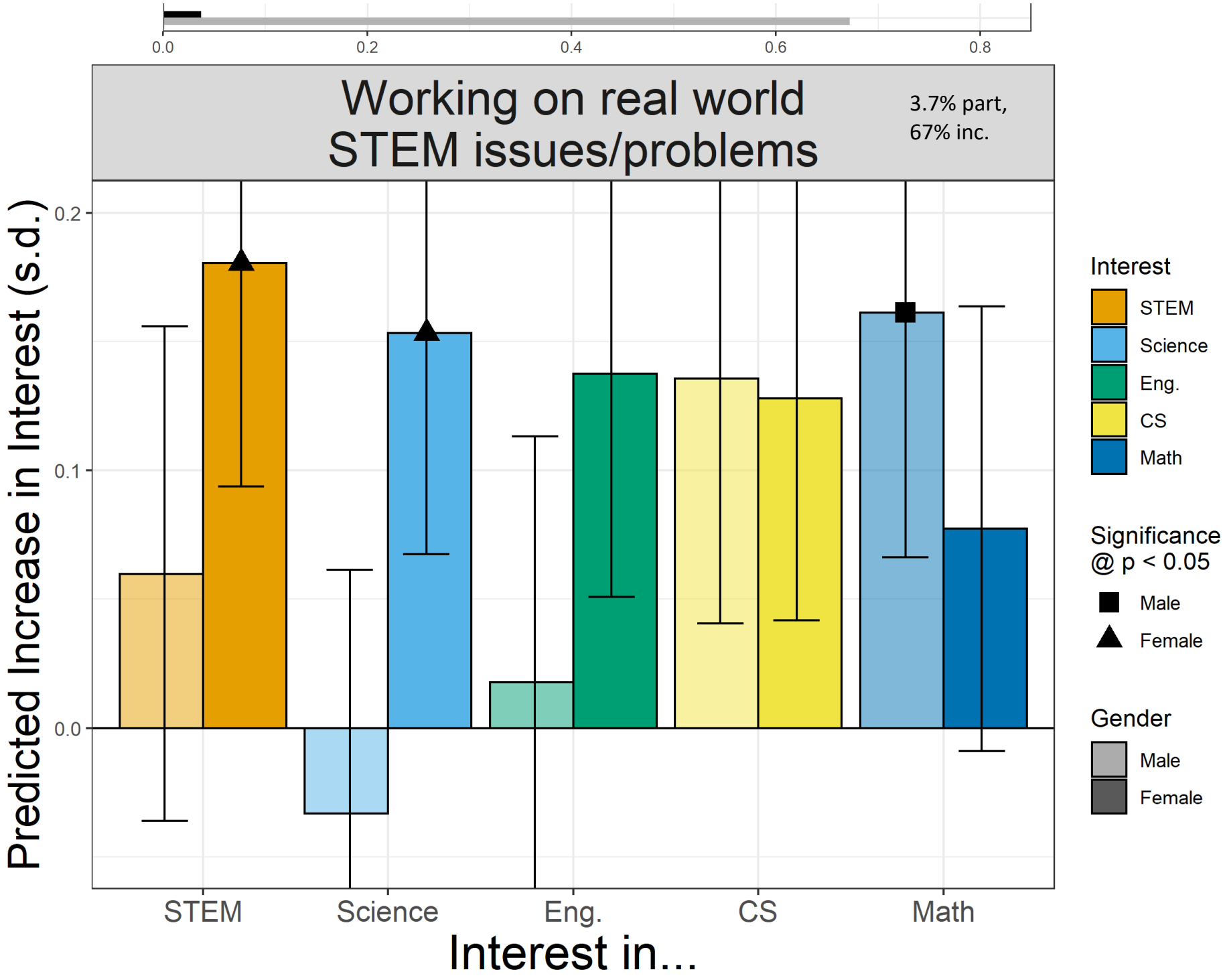

0.0
0.2
0.4
0.6
0.8
Taking on a leadership role
6.9% part,
51% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

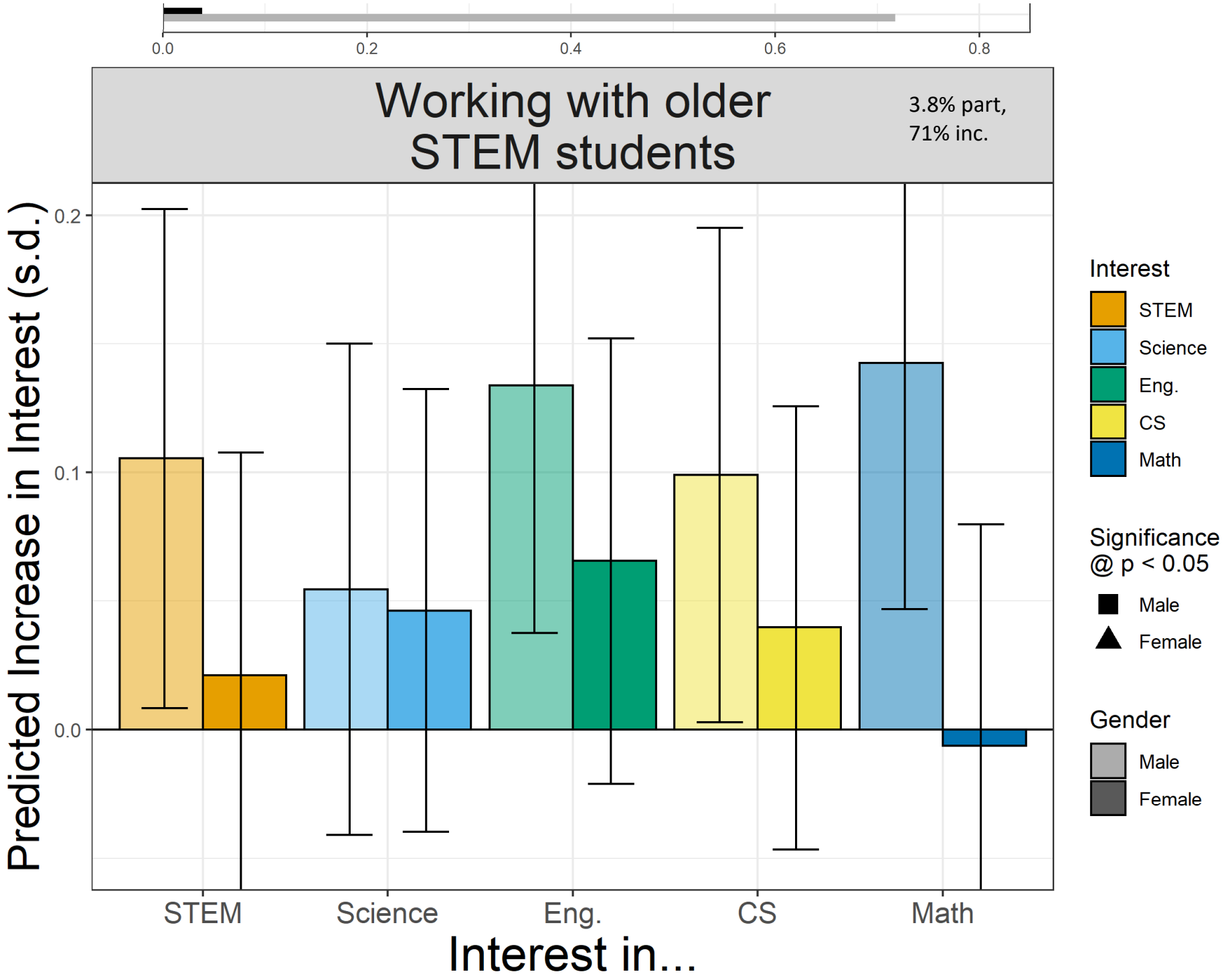

0.0
0.2
0.4
0.6
0.8
Tours of STEM places
18% part,
28% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

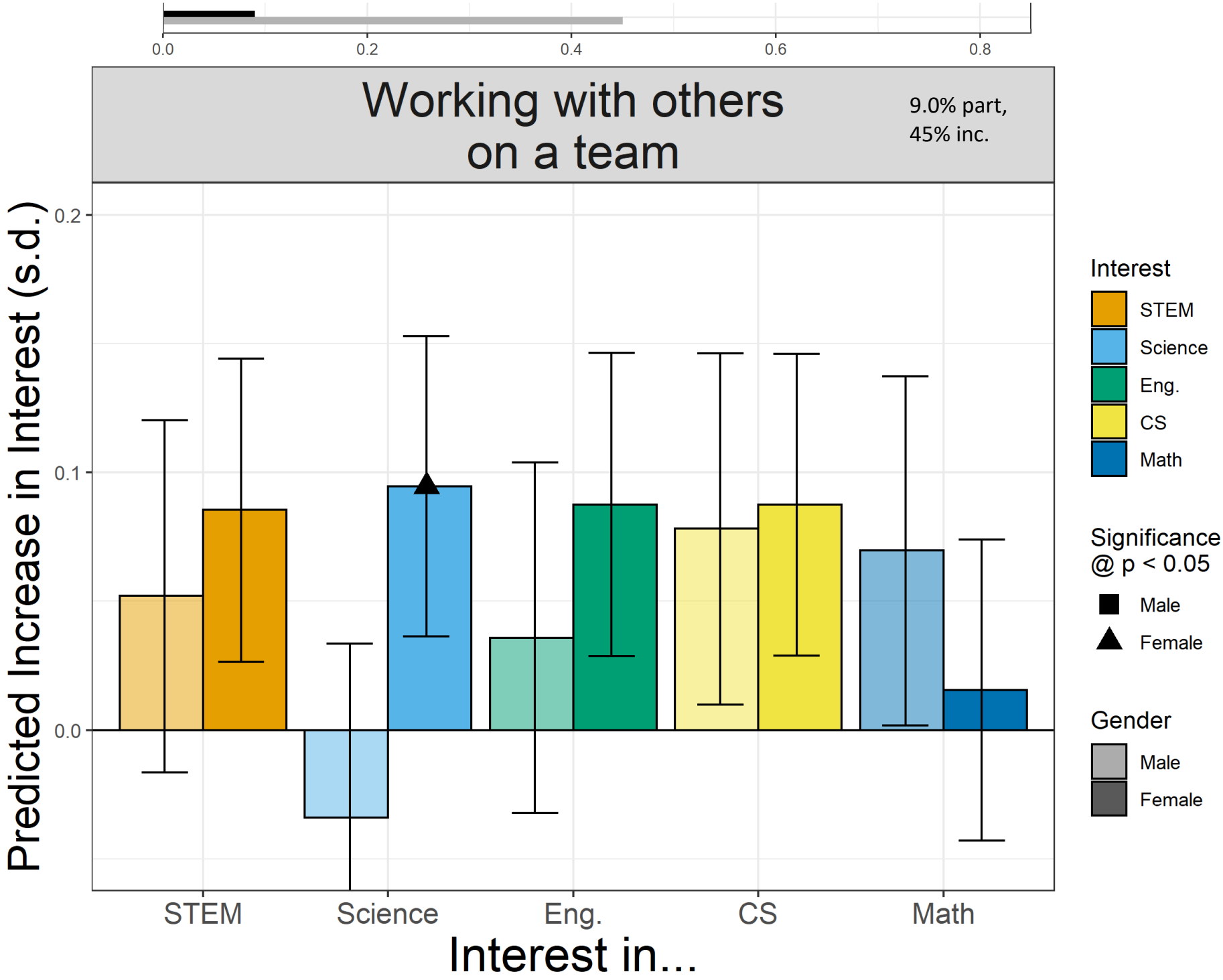

0.0
0.2
0.4
0.6
0.8
Using STEM equipment to collect data
4.4% part,
56% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female

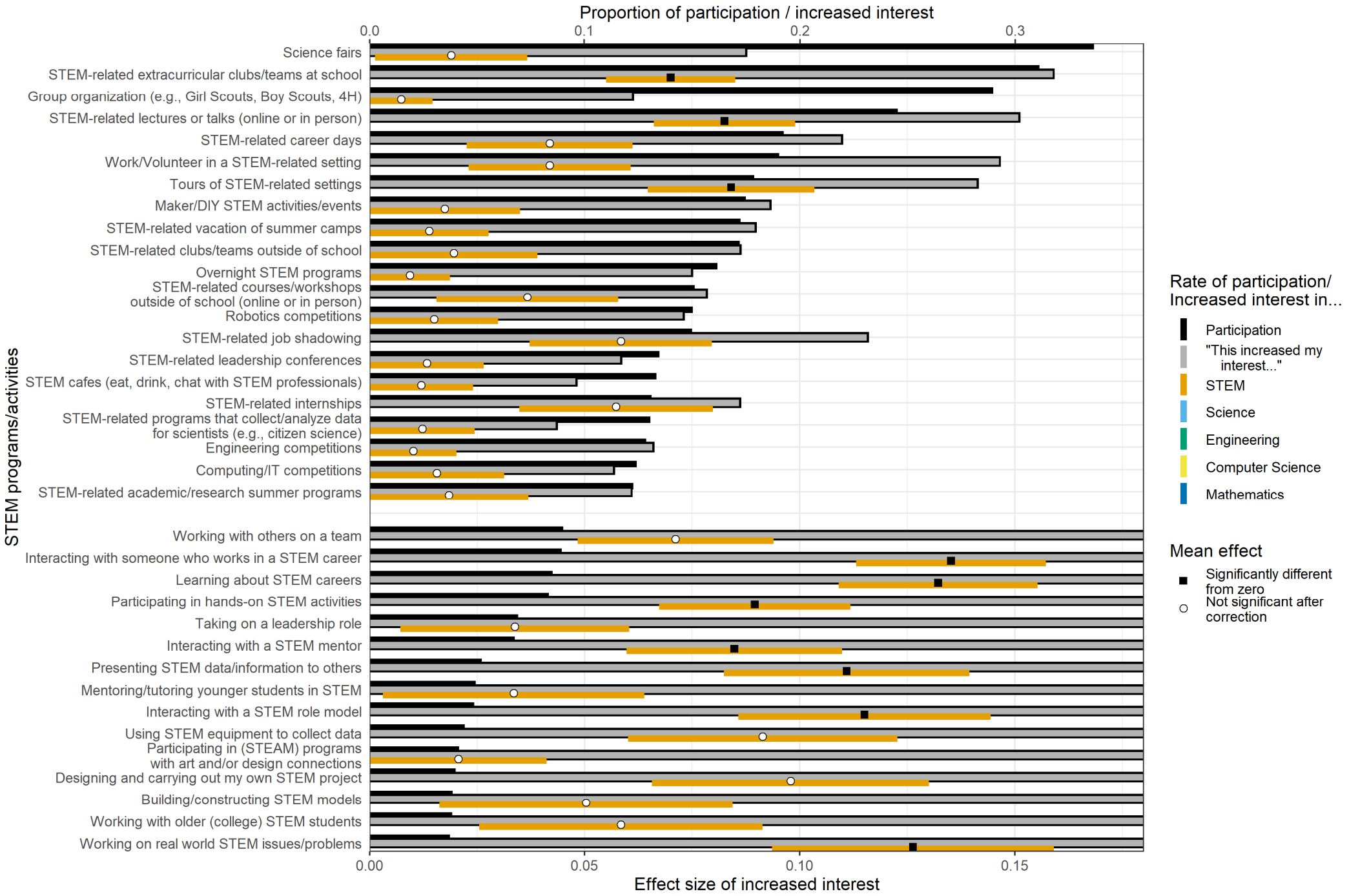

0.0
0.2
0.4
0.6
0.8
Vacation or summer camps
17% part,
18% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female

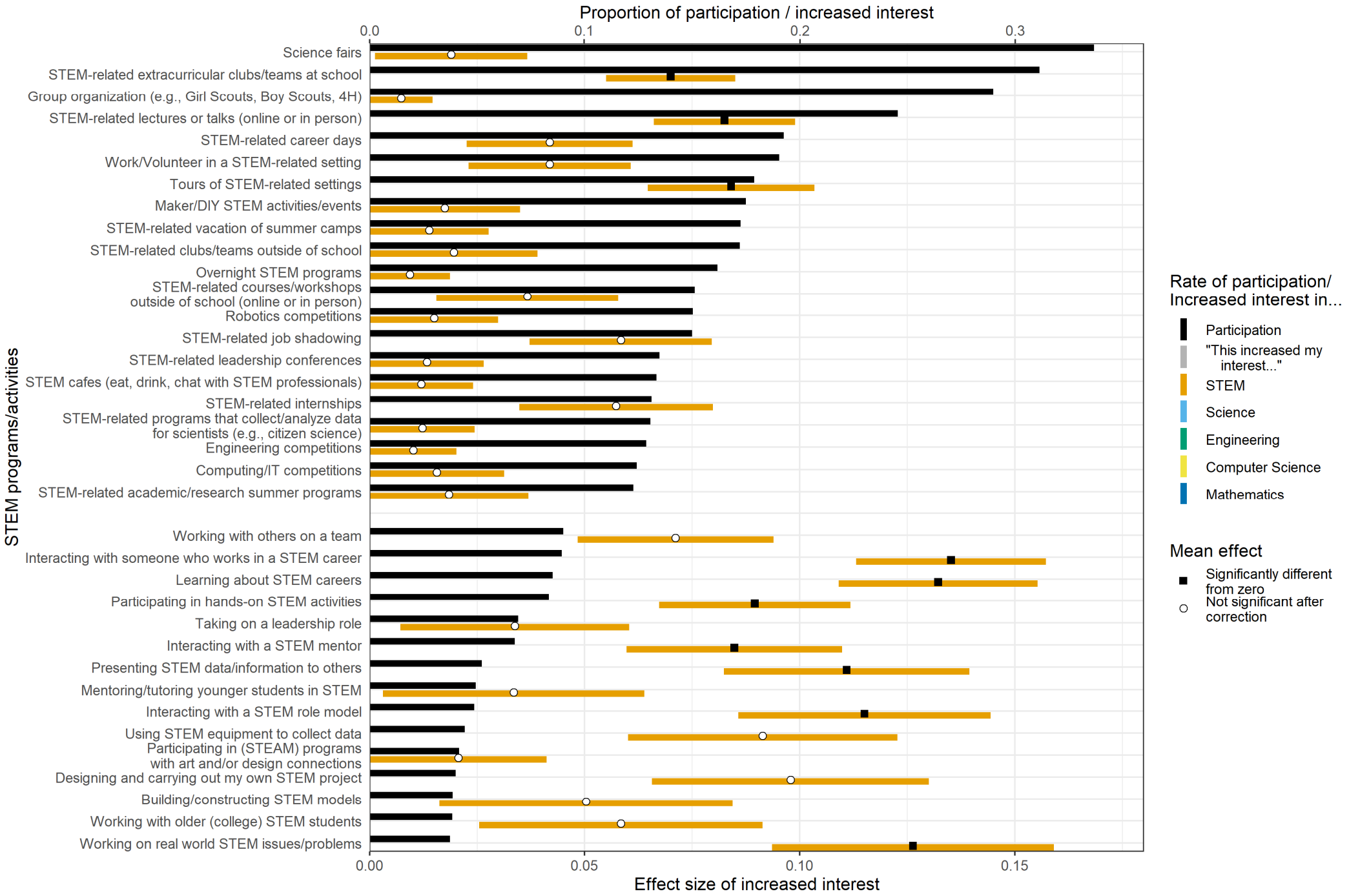

0.0
0.2
0.4
0.6
0.8
Volunteering in STEM setting
19% part,
29% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Working on real world
STEM issues/problems
3.7% part,
67% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance
@ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Working with older STEM students
3.8% part, 71% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female


0.0
0.2
0.4
0.6
0.8
Working with others on a team
9.0% part, 45% inc.
Predicted Increase in Interest (s.d.)
0.2
0.1
0.0
STEM
Science
Eng.
CS
Math
Interest in...
Interest
STEM
Science
Eng.
CS
Math
Significance @ p < 0.05
Male
Female
Gender
Male
Female


Proportion of participation / increased interest
0.0
0.1
0.2
0.3
Science fairs
STEM-related extracurricular clubs/teams at school
Group organization (e.g., Girl Scouts, Boy Scouts, 4H)
STEM-related lectures or talks (online or in person)
STEM-related career days
Work/Volunteer in a STEM-related setting
Tours of STEM-related settings
Maker/DIY STEM activities/events
STEM-related vacation of summer camps
STEM-related clubs/teams outside of school
Overnight STEM programs
STEM-related courses/workshops outside of school (online or in person)
Robotics competitions
STEM-related job shadowing
STEM-related leadership conferences
STEM cafes (eat, drink, chat with STEM professionals)
STEM-related internships
STEM-related programs that collect/analyze data for scientists (e.g., citizen science)
Engineering competitions
Computing/IT competitions
STEM-related academic/research summer programs
Working with others on a team
Interacting with someone who works in a STEM career
Learning about STEM careers
Participating in hands-on STEM activities
Taking on a leadership role
Interacting with a STEM mentor
Presenting STEM data/information to others
Mentoring/tutoring younger students in STEM
Interacting with a STEM role model
Using STEM equipment to collect data
Participating in (STEAM) programs with art and/or design connections
Designing and carrying out my own STEM project
Building/constructing STEM models
Working with older (college) STEM students
Working on real world STEM issues/problems
STEM programs/activities
0.00
0.05
0.10
0.15
Effect size of increased interest
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
STEM
Science
Engineering
Computer Science
Mathematics
Mean effect
Significantly different from zero
Not significant after correction


Proportion of participation / increased interest
0.0
0.1
0.2
0.3
Science fairs
STEM-related extracurricular clubs/teams at school
Group organization (e.g., Girl Scouts, Boy Scouts, 4H)
STEM-related lectures or talks (online or in person)
STEM-related career days
Work/Volunteer in a STEM-related setting
Tours of STEM-related settings
Maker/DIY STEM activities/events
STEM-related vacation of summer camps
STEM-related clubs/teams outside of school
Overnight STEM programs
STEM-related courses/workshops outside of school (online or in person)
Robotics competitions
STEM-related job shadowing
STEM-related leadership conferences
STEM cafes (eat, drink, chat with STEM professionals)
STEM-related internships
STEM-related programs that collect/analyze data for scientists (e.g., citizen science)
Engineering competitions
Computing/IT competitions
STEM-related academic/research summer programs
Working with others on a team
Interacting with someone who works in a STEM career
Learning about STEM careers
Participating in hands-on STEM activities
Taking on a leadership role
Interacting with a STEM mentor
Presenting STEM data/information to others
Mentoring/tutoring younger students in STEM
Interacting with a STEM role model
Using STEM equipment to collect data
Participating in (STEAM) programs with art and/or design connections
Designing and carrying out my own STEM project
Building/constructing STEM models
Working with older (college) STEM students
Working on real world STEM issues/problems
STEM programs/activities
0.00
0.05
0.10
0.15
Effect size of increased interest
Rate of participation/ Increased interest in...
Participation
"This increased my interest..."
STEM
Science
Engineering
Computer Science
Mathematics
Mean effect
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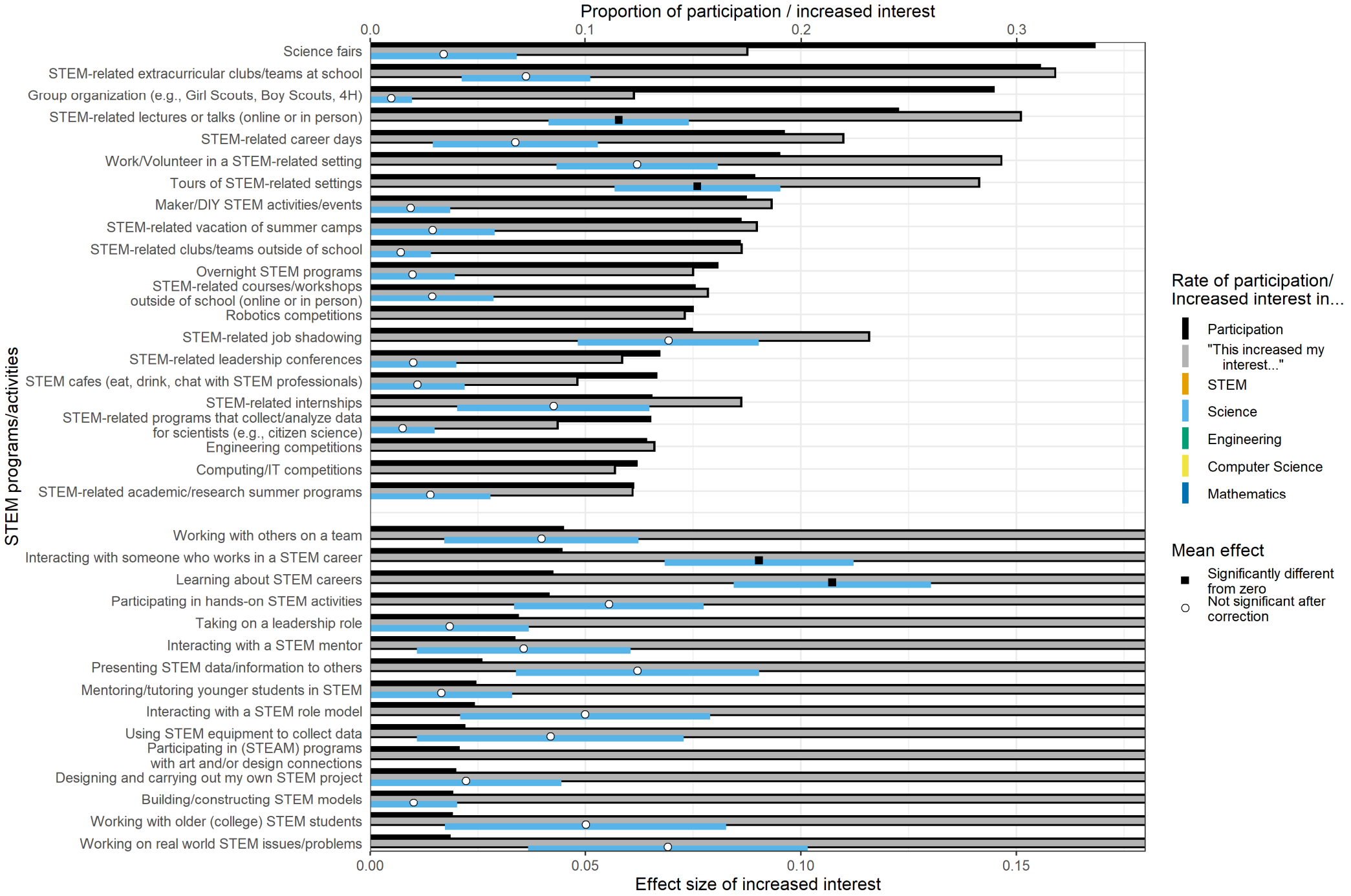
Not significant after correction


Proportion of participation / increased interest
0.0
0.1
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Science fairs
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STEM-related academic/research summer programs
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Interacting with a STEM role model
Using STEM equipment to collect data
Participating in (STEAM) programs with art and/or design connections
Designing and carrying out my own STEM project
Building/constructing STEM models
Working with older (college) STEM students
Working on real world STEM issues/problems
STEM programs/activities
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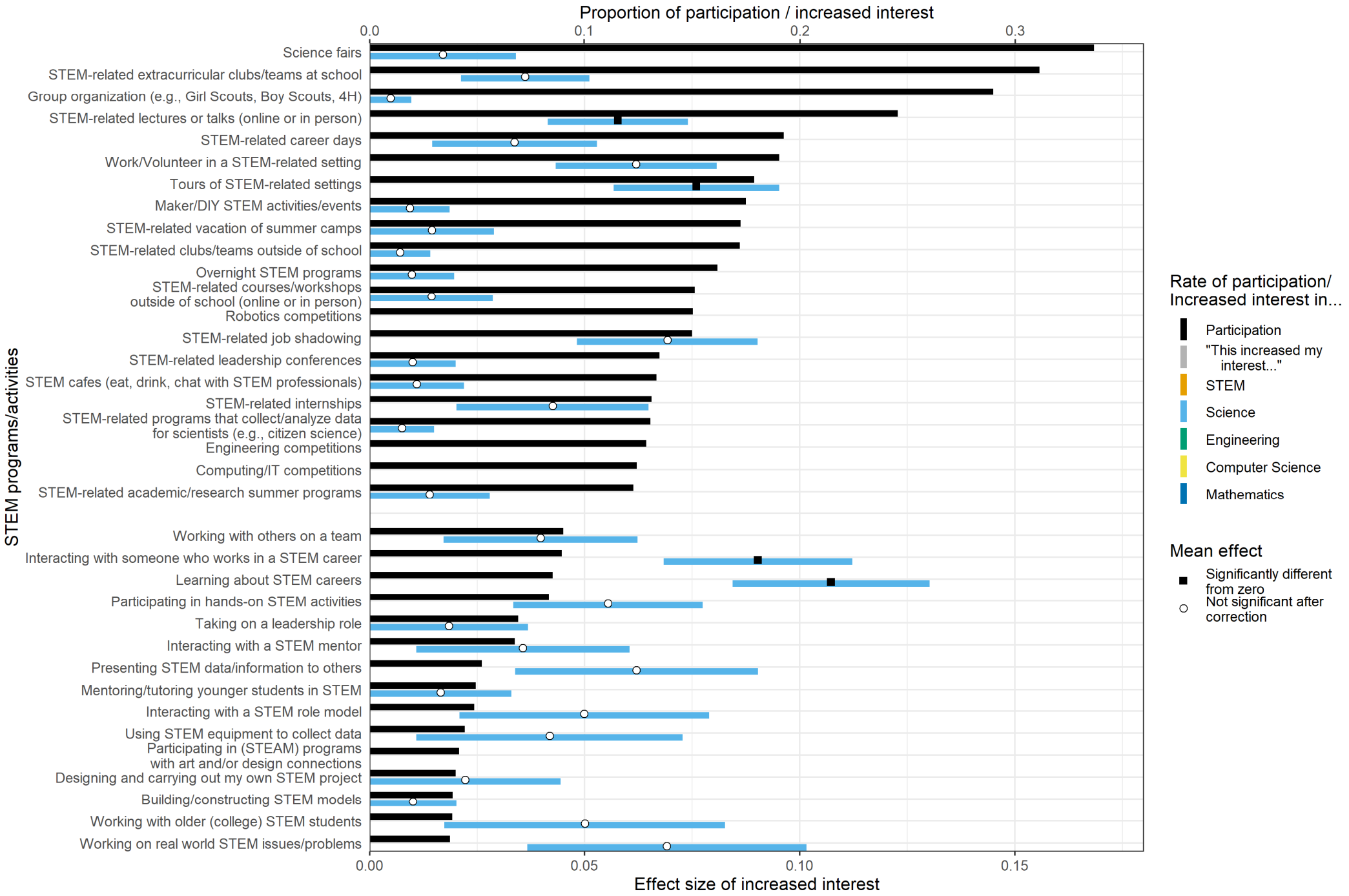
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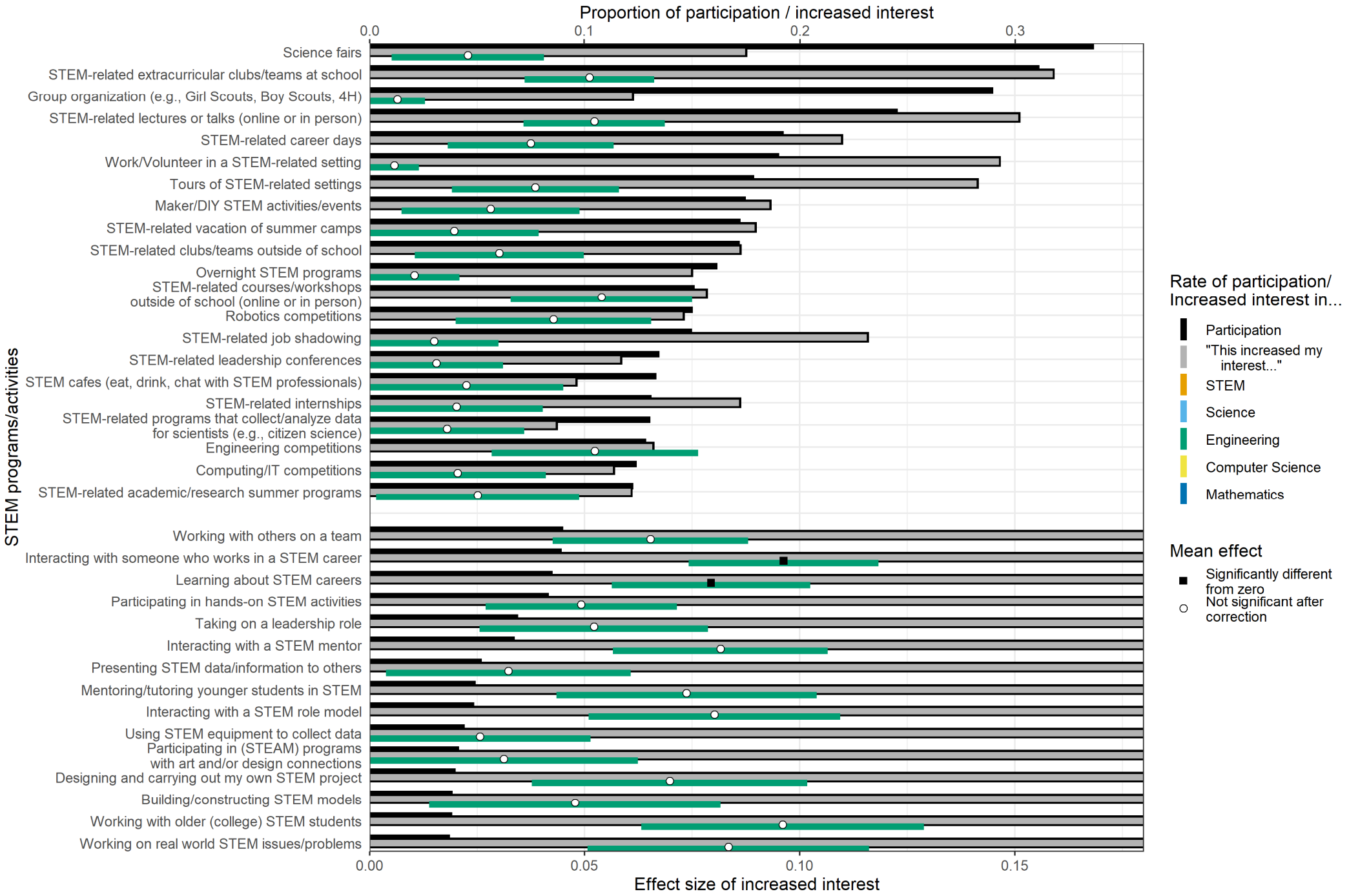
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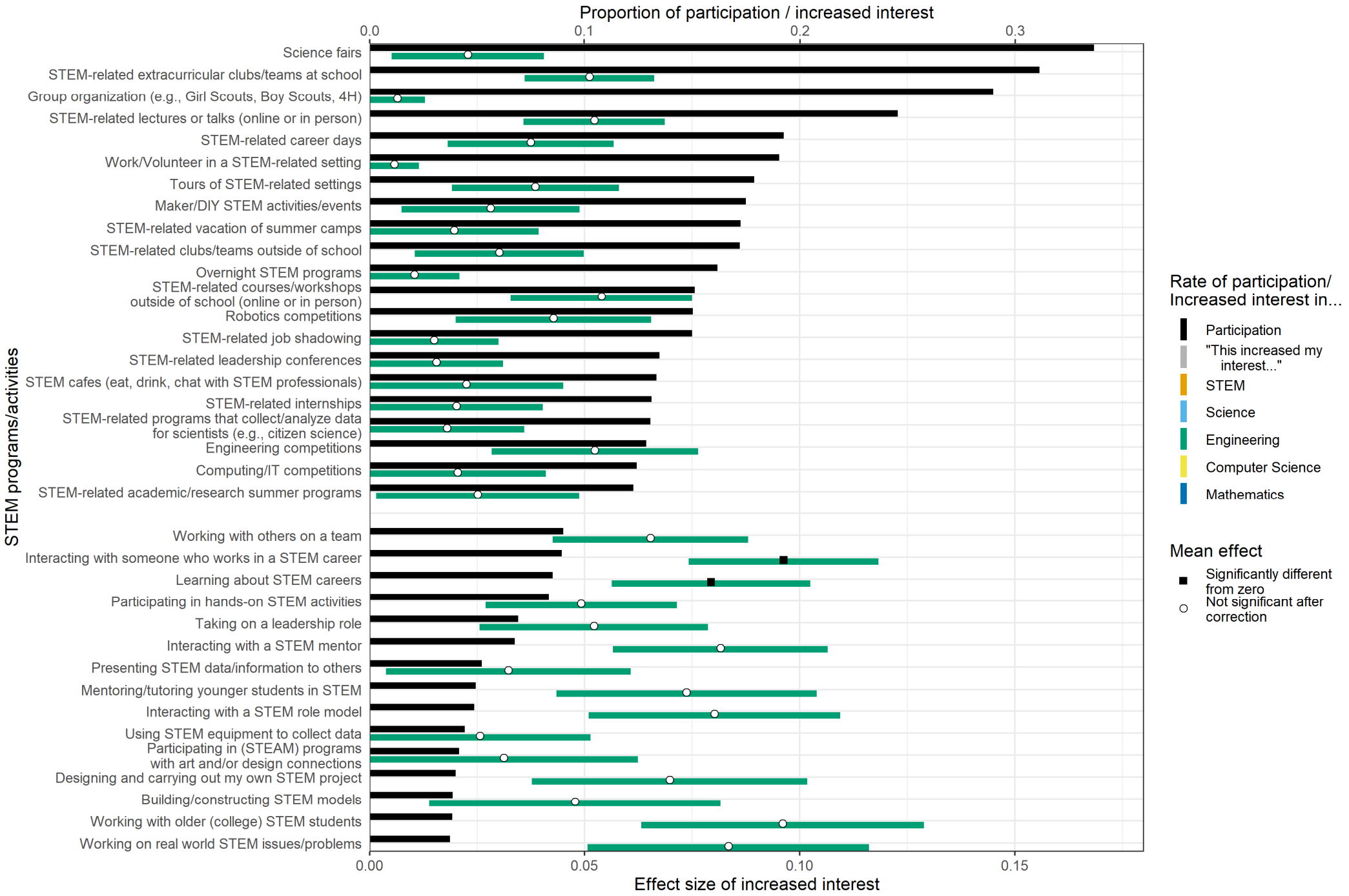
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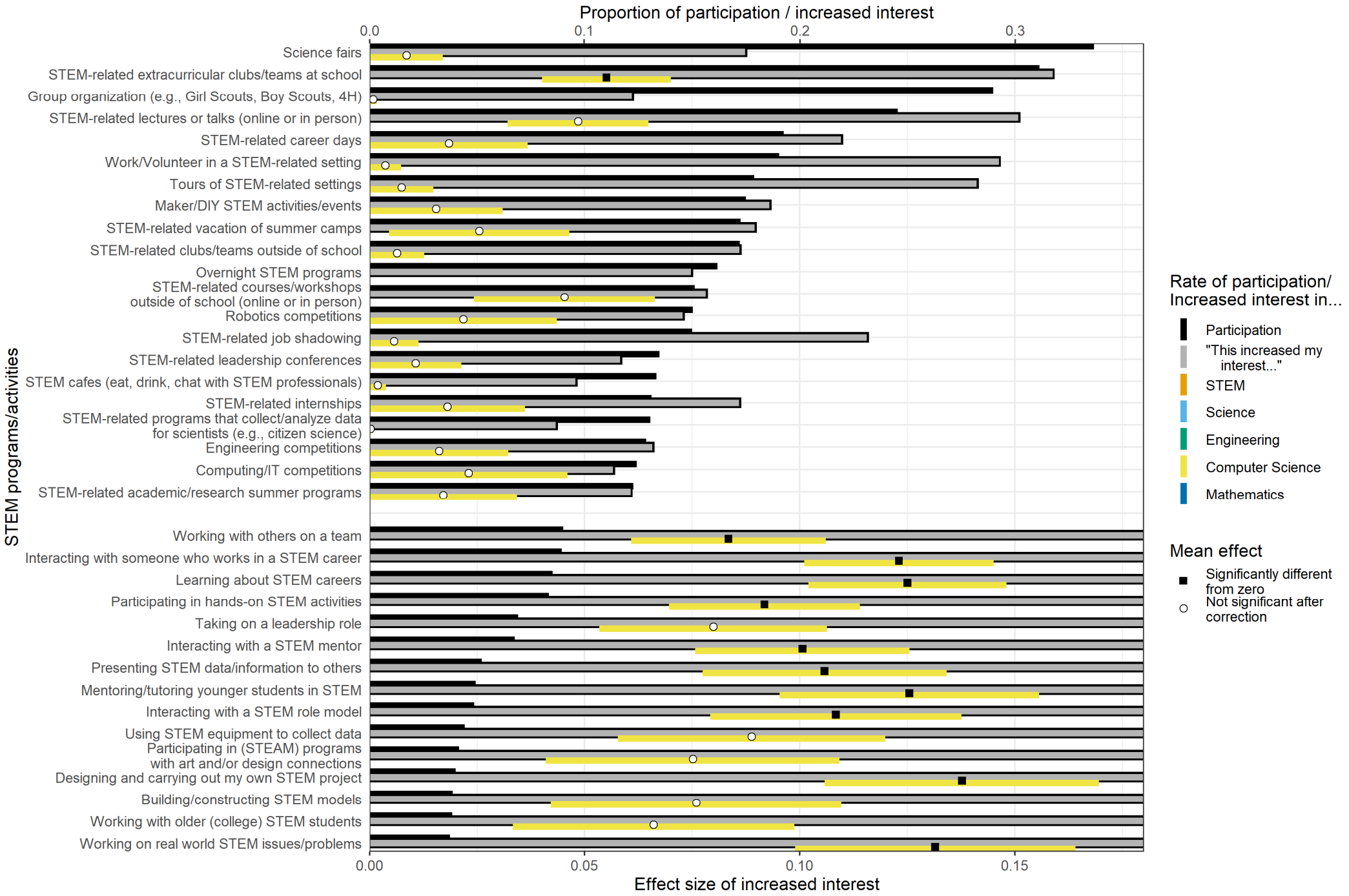
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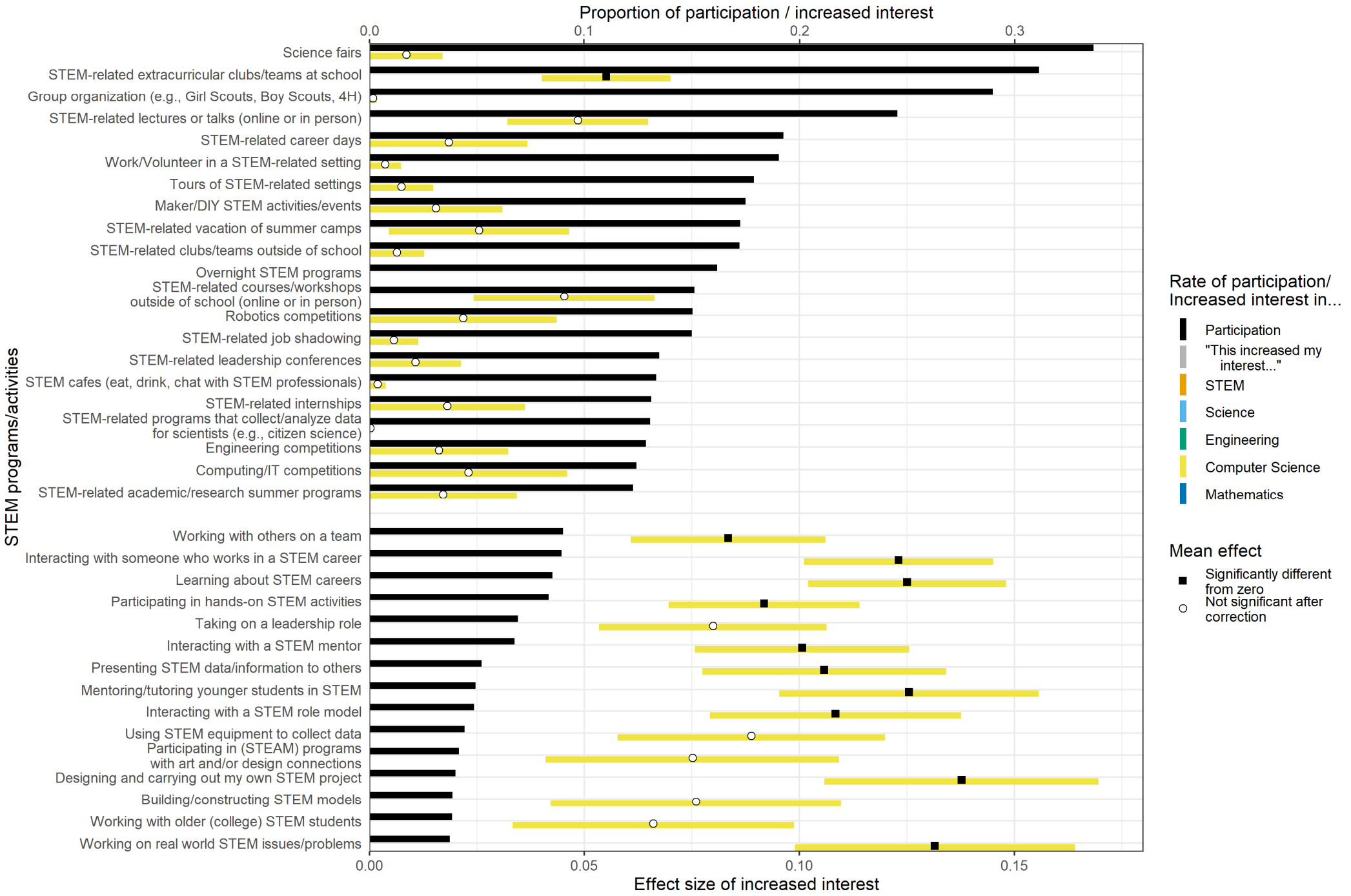
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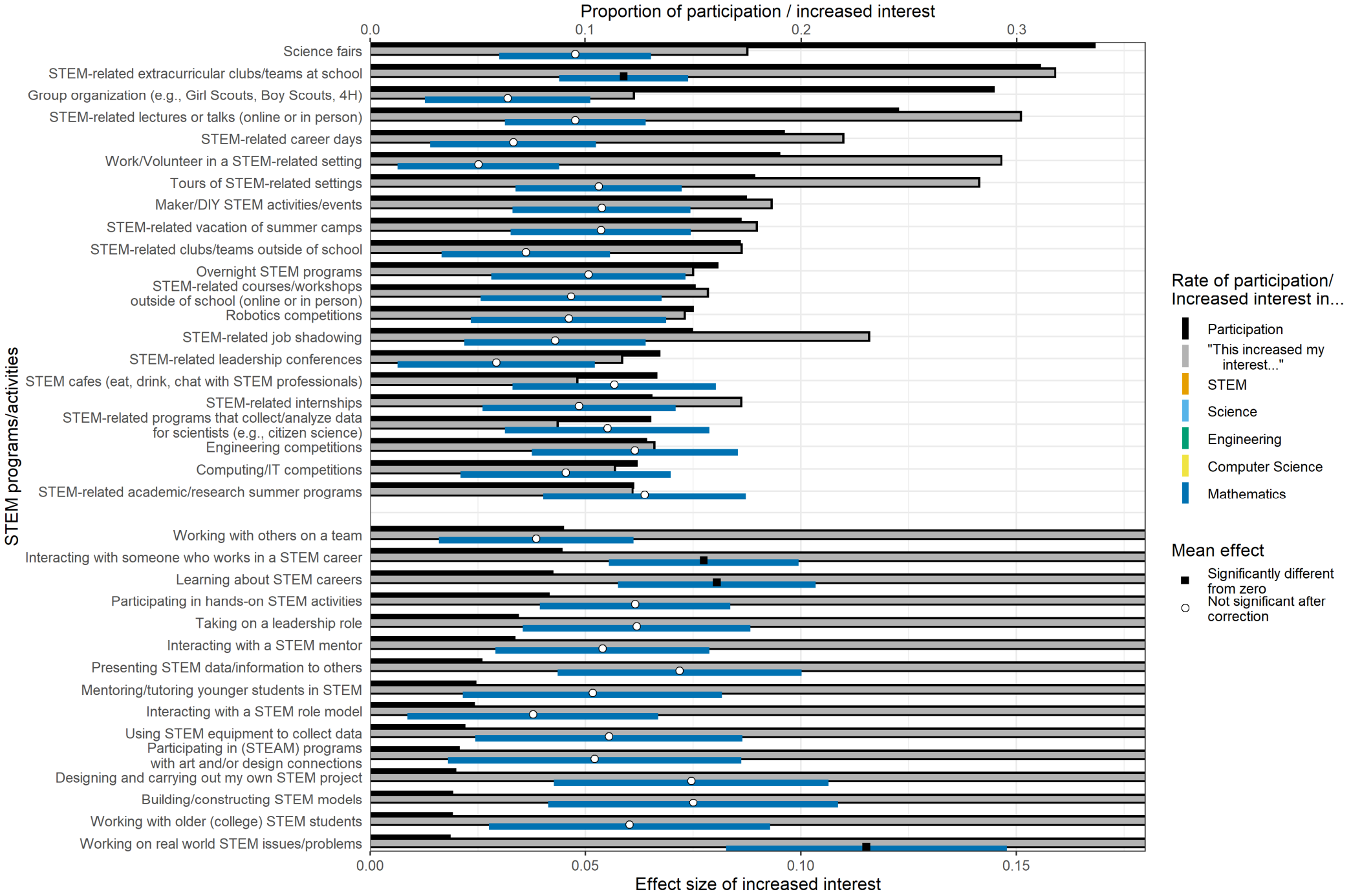
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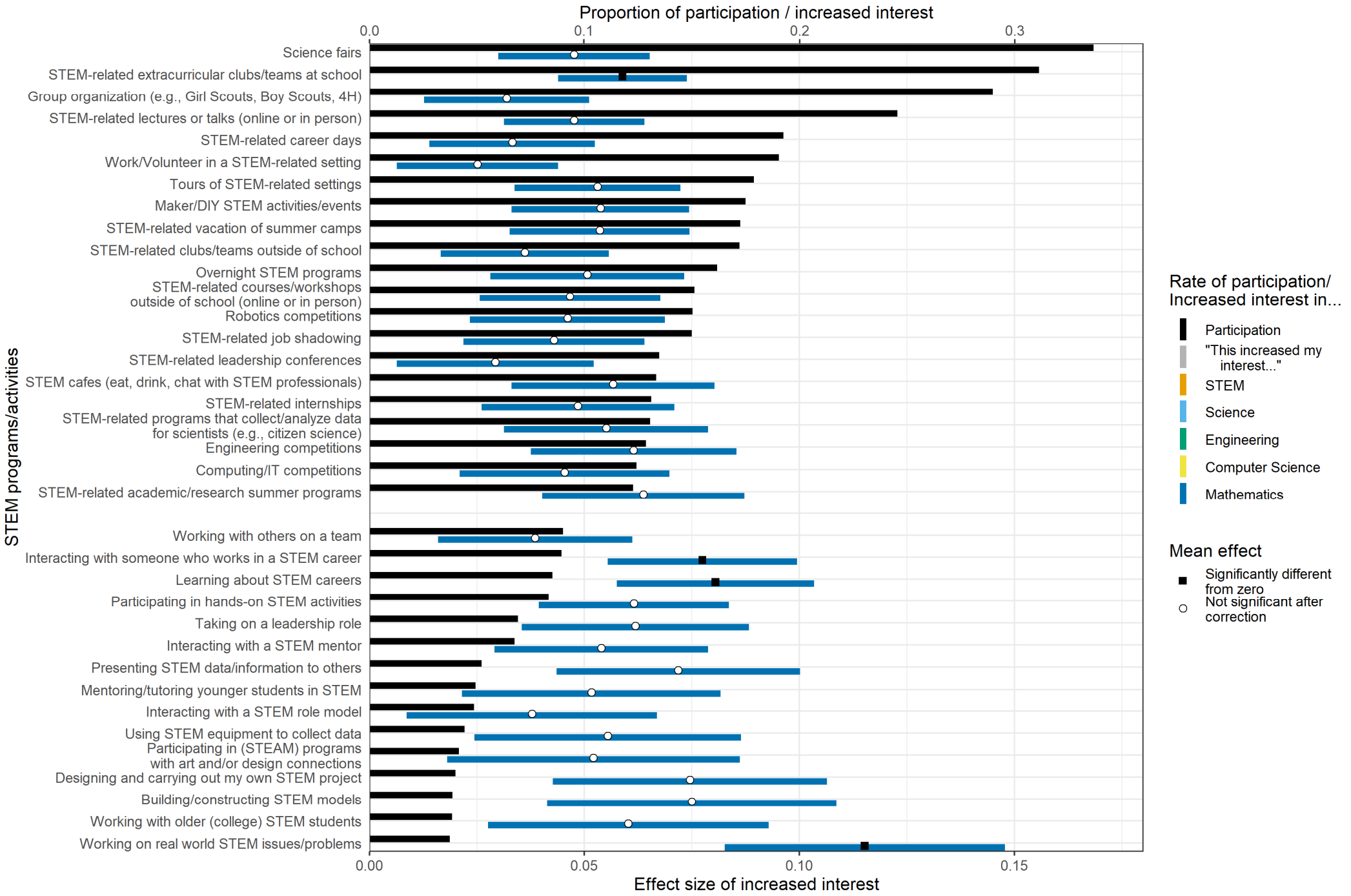
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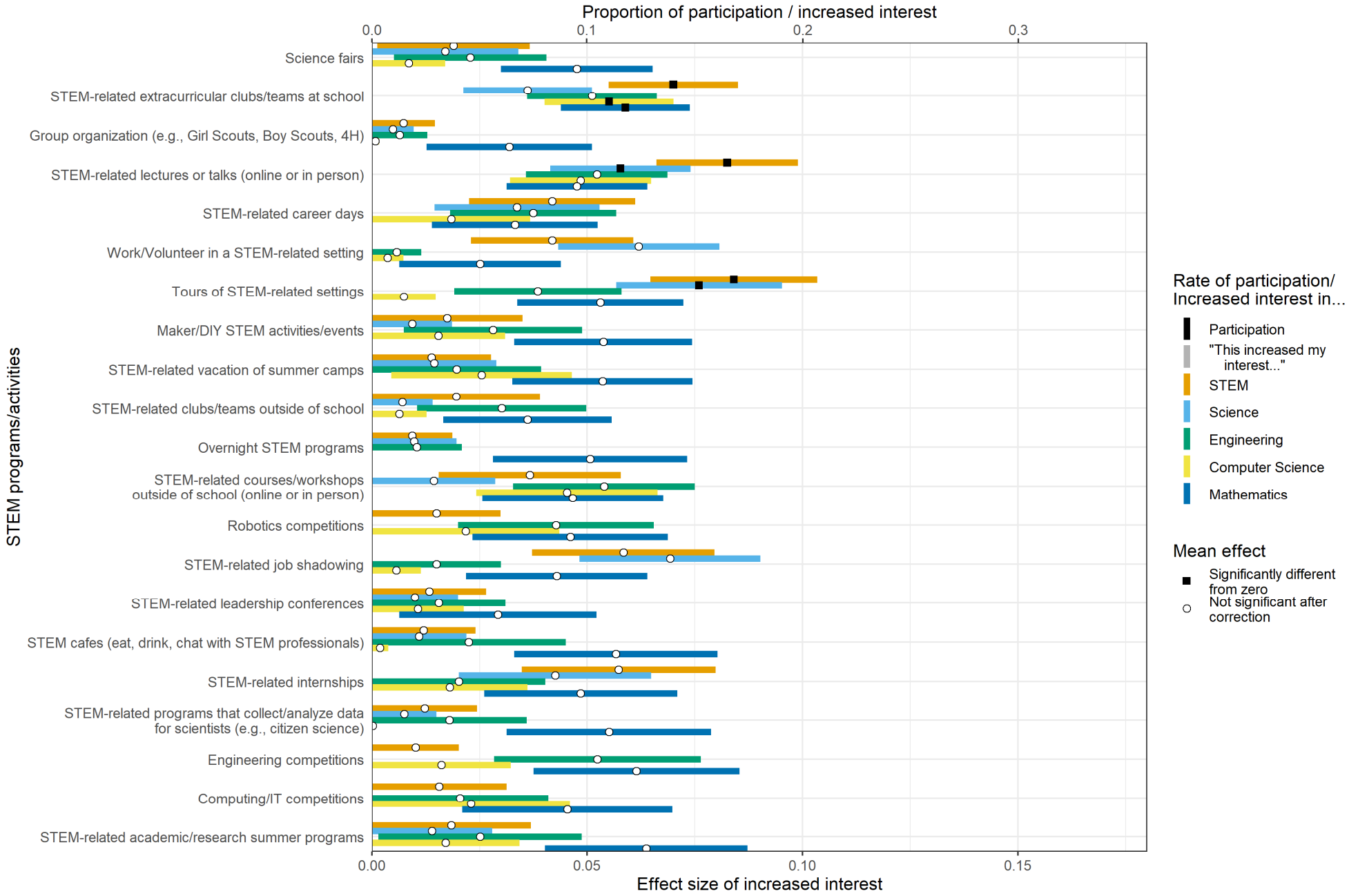
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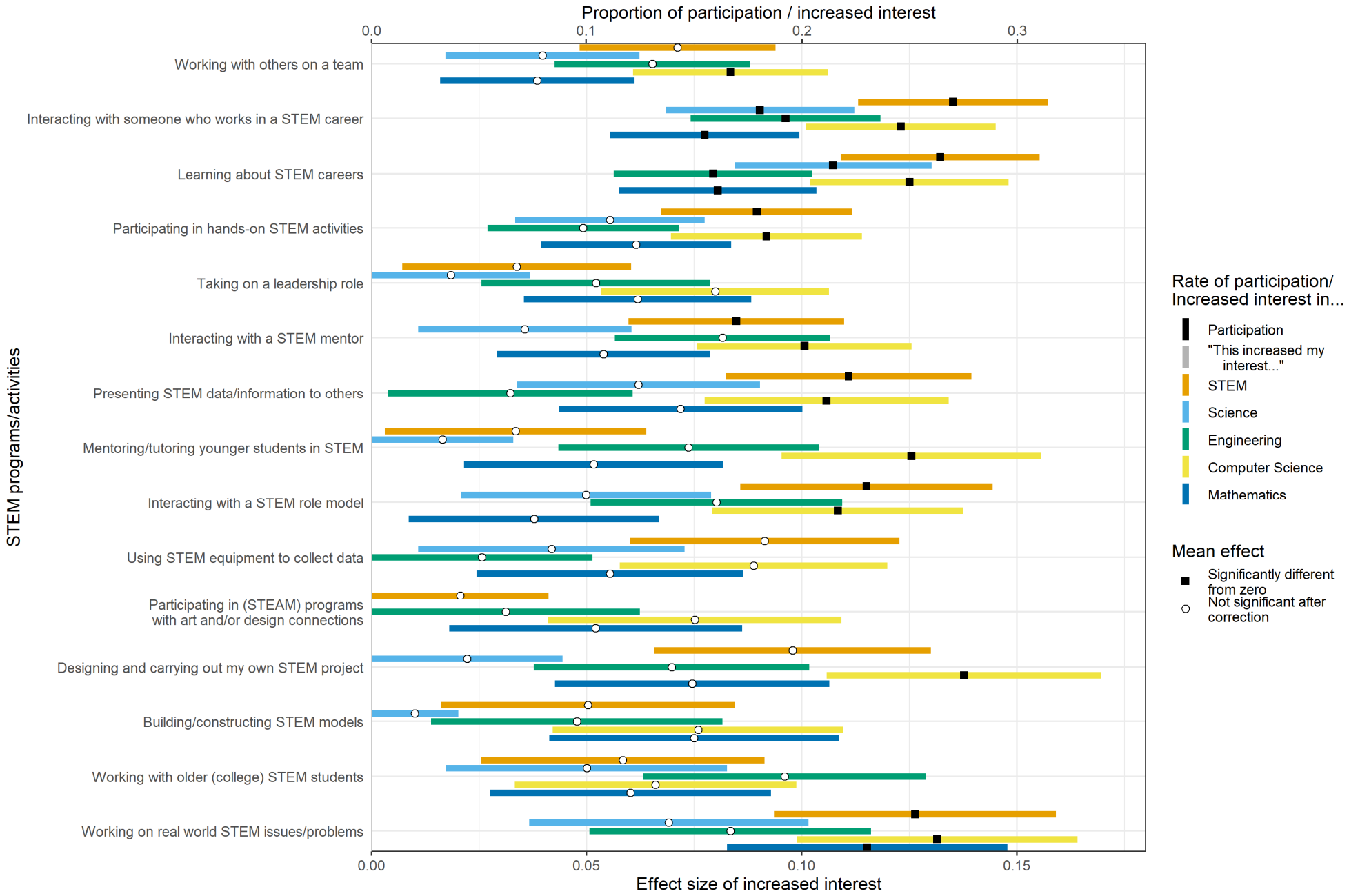
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