

Elementary Students’ STEM Competence: The Role of Teacher Practices and Classroom Climate



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- INTRO
- **Critical shortage** of adults earning degrees and pursuing careers in **STEM-related fields** (NSF, 2015).
  - Insufficient participation by U.S. citizens critically endangers sustainability of technology-based society (NSF, 2010; PCAST, 2010).
  - **Female workforce in engineering = 15%, physical sciences = 28% and computer/mathematical = 26%** in 2015
  - **Hispanics’ (6%) and African Americans’ (5%)** employment rate in STEM occupations is lower than their share of the US adult population (**15% and 12%**, respectively) (NSF, 2018).
  - Early academic experiences affect one’s motivation to learn and later skill development (Heckman, 2006)
    - Goal: understand children’s early experiences to address occupational disparities long-term.
  - Ecological frameworks (Bronfenbrenner, 2005) indicate importance of classroom context in developmental trajectories of competency-beliefs.
    - Gap: Understanding mechanisms linking teacher practices and classroom climate to students’ competency-beliefs in STEM content areas (science, technology, engineering, math).

- RESEARCH QUESTIONS
1. How do relations between different aspects of teacher practices relate to teacher perceptions of classroom climate?
  2. What are the relations between classroom climate and student report of competence in math and engineering-related activities/skills?

- METHOD
- Grades K-5 from Southwestern schools
  - **Teacher Reports** (N = 154, 90.9% female)
    - Classroom Practices (PRA)
    - Classroom Climate (CLI)
  - **Student Report** (N = 1629 , 51.6% female)
    - Competence (COM)

RESULTS

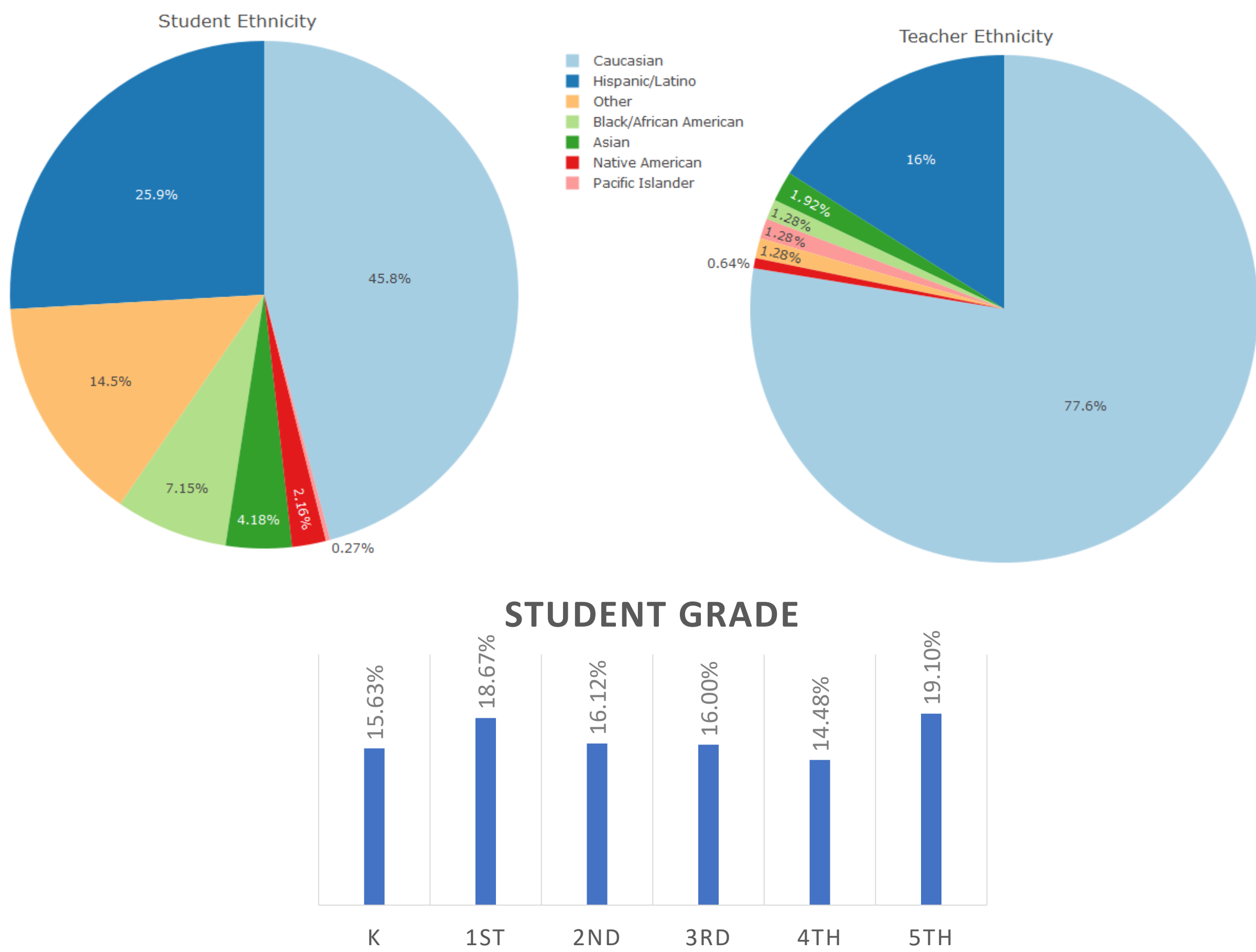
RQ	Variables	$\beta$	SE	t-value
1	CLI-NEGENV on PRA-GEN	0.22	0.08	2.90**
2	COM-MATH on CLI-NEGENV	-0.29	0.10	-2.84**
2	COM-MATH on CLI-RESP	-0.35	0.12	-2.87**
2	COM-A/S on CLI-RESP	0.11	0.03	3.08*

- \*Significant at p < .05, \*\*Significant at p < .001
- DISCUSSION
- Teachers should re-evaluate classroom practices and take steps to minimize/eliminate gendered stereotyped practices.
  - A positive classroom environment fosters higher levels of competence, so teachers need to be cognizant of fostering a positive environment.
  - Respect also affects perceptions of competence, so classroom practices can incorporate respect-promoting aspects.

Gender stereotyped practices in the classroom negatively influence students’ perceived math competence.

A respectful classroom environment positively relates to engineering competence.

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- Teacher Report Measures
- Classroom Practices (PRA)
    - 4 Growth Mindset (PRA-GRO): e.g., “Encourage students to ask the teacher why the class is learning a topic.” [Dweck, 2015; Mindset Works]
    - 5 Gender Stereotyped (PRA-GEN): e.g., “Create girl and boy teams for friendly competitions.” [Gaertner & Miller, 2010, unpublished]
  - Classroom Climate (CLI) [Lickona & Davidson, 2003]
    - 9 Peer (CLI-PEER): e.g., “Students work well together.”
    - 4 Negative Environment (CLI-NEGENV): e.g., “Students show poor sportsmanship.”
    - 4 Respect (CLI-RESP): e.g., “Students behave respectfully toward all school staff (including secretaries, custodians, and aides).”
  - Likert-scale 0 - 4 (“Never” to “All of the time”)

- Student Report Measures
- Competence (COM) [Eccles & Wigfield, 2002; Wheeler et al., 2019, unpublished]
    - 1 Math (COM-MATH): e.g., “How good are you at math?”
    - 10 Engineering Activities and Skills: (COM-A/S) e.g., “How good are you at trying out your ideas?”
  - Likert-scale 0 - 3 (“Not at all good” to “Very good”)

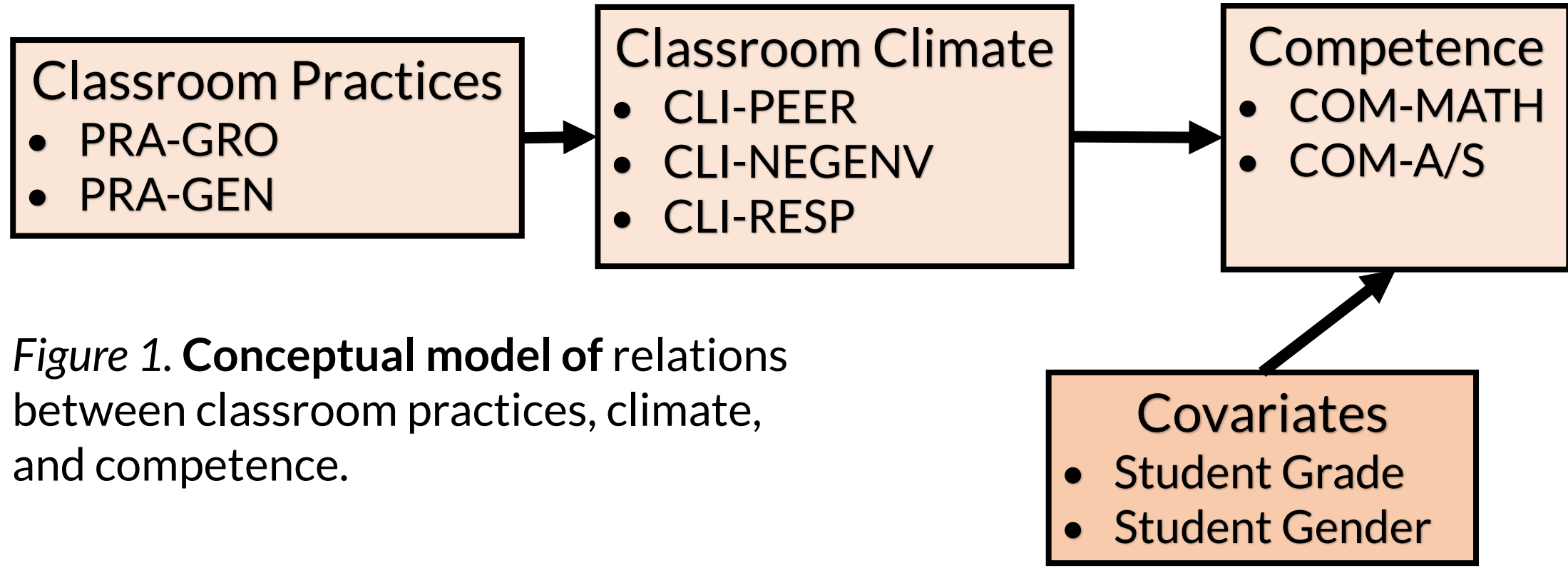


Figure 1. Conceptual model of relations between classroom practices, climate, and competence.

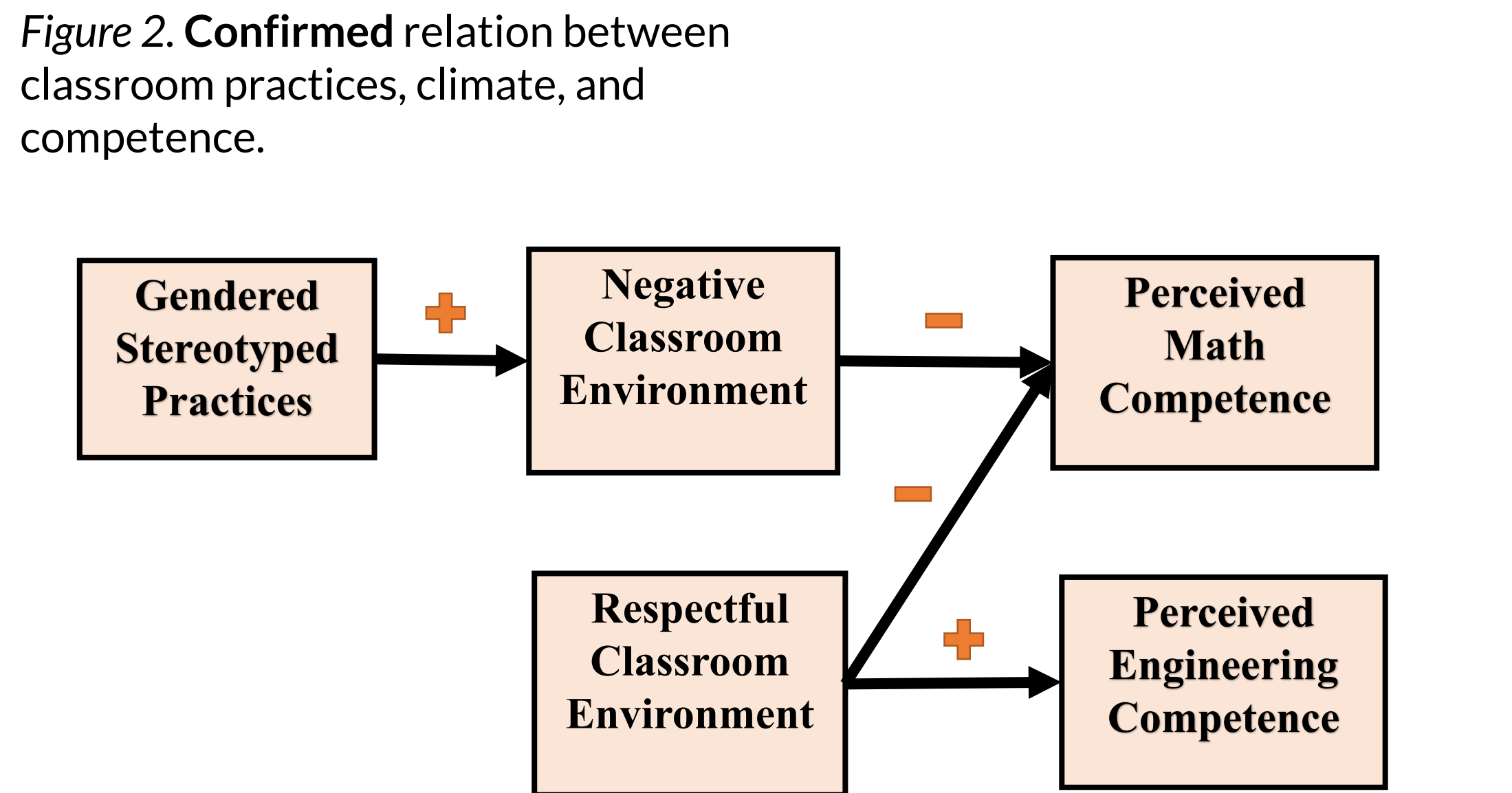


Figure 2. Confirmed relation between classroom practices, climate, and competence.