

How do the social structures of a peer mentoring program relate to achievement goals and persistence for female undergraduate freshman in STEM majors?

Institute for STEM Education

 STONY BROOK UNIVERSITY



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Learning environments play an important role in developing competencies and/or outperforming others [1].

Goal orientations include beliefs about the purposes of goals, and the meaning of success, ability, effort, and failure. [1, 3].

Motivational beliefs, which are informed by aptitudes in mathematics and science, competence beliefs, interest, and career goals, play a large role in the decision to pursue and persist in STEM fields [2, 3].

1. Ames, 1992
2. Dweck & Leggett, 1988
3. Wang & Degol, 2013

The goals individuals adopt in learning settings have important implications for academic behaviors.

Achievement goals may act as a mediator between competency beliefs and achievement related behaviors.

Wang and Degol, 2013

A mastery goal orientation refers to development of competence and interest in learning new skills.

Dweck and Leggett, 1988

Performance goal orientations focus on demonstration of competence by outperforming others.

Furner and Gonzalez-DeHass, 2011

A large body of literature supports achievement goal theory in predicting achievement related behaviors; however, the relationship among achievement goals and achievement related outcomes, particularly for women in STEM, is not clear.

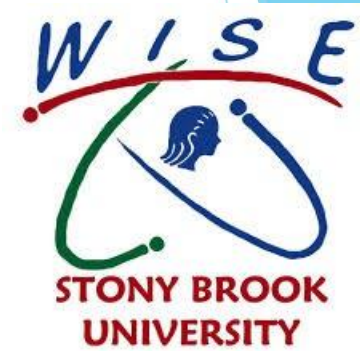
Problem

The purpose of this study is to explore the relationships between social structures of a peer mentoring program, competency beliefs and achievement goals in women first-year science and engineering majors in an effort to increase retention of women in STEM majors.

Purpose

Goals of the program:

1. Provide academic excellence
2. Promote professional development
3. Facilitate research opportunities
4. Establish and maintain community outreach
5. Encourage global collaboration
6. Enact inclusive strategies





The program emphasizes academic excellence, service, and leadership with a research and career focus.

WISE students reside together freshman year in a designated dormitory designed to promote social acclimation.

Groups of 5-6 participate in a mandatory weekly study and discussion group led by an upper-class undergraduate mentor.

Attend evening programs specially designed to introduce and advise students to the opportunities in science and engineering both on and off campus.

Research Design: Convergent parallel mixed methods

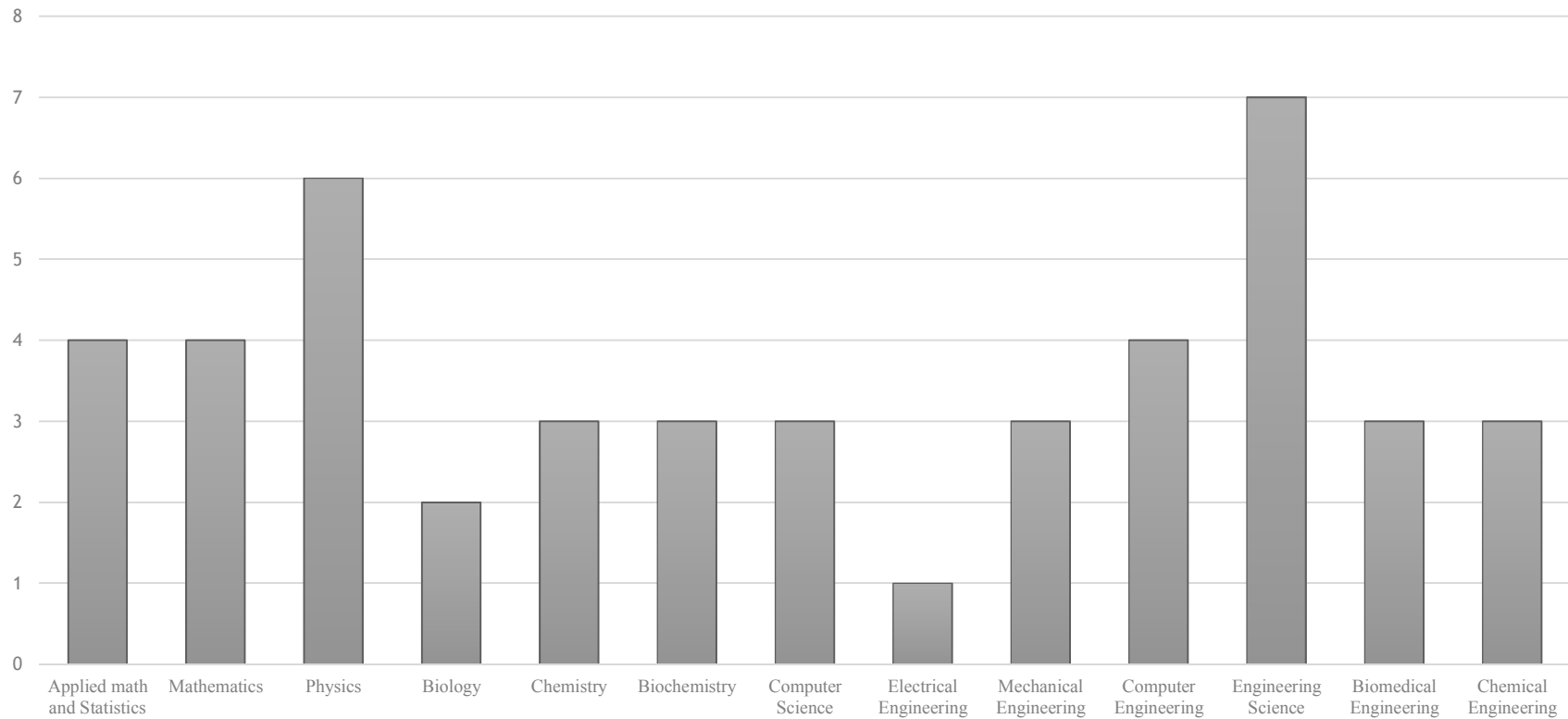
Social constructs, achievement goals, and competency were measured from a survey adapted from Assessing Women and Men in Engineering ($\alpha = .72$). Qualities valued in a mentor measured qualitatively by responses to open ended questions.



N = 46 females were WISE undergraduate first-year students declaring science or engineering majors.

- ▶ The ethnicities of undergraduate students in 2019 were reported as:
- ▶ 33% White
- ▶ 46% Asian and Pacific American
- ▶ 8% Latino/Hispanic American
- ▶ 6% African American
- ▶ 4% Other: Middle Eastern and East Asian

Breakdown of freshman participant majors in the WISE Honors Program 2018 - 2019



Social constructs

- ▶ 92% of first year students reported that they feel welcome when participating in S & E professional societies or extracurricular activities
- ▶ 63% reported enjoying working on group work with other students outside of classes
- ▶ 52% had many friends studying in their disciplines

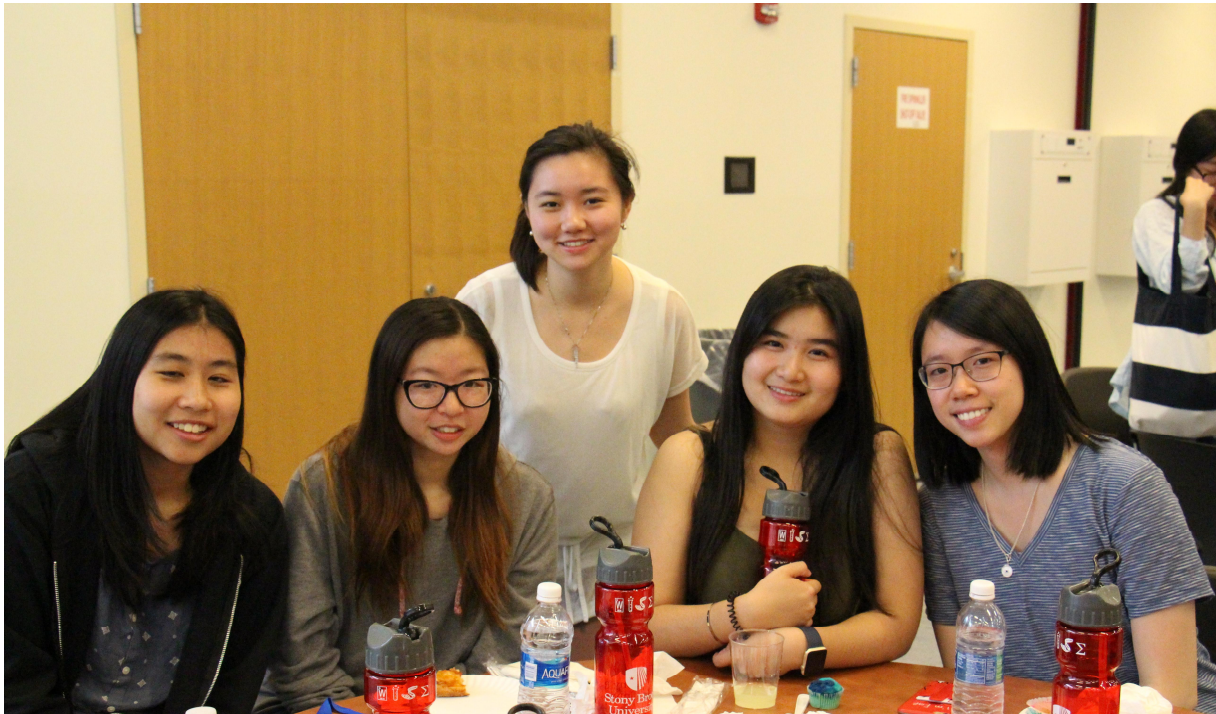


Table 1: Percent agreement with goal statements ($n = 46$).

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Mastery-oriented goals:					
One of my goals in my science and/or engineering classes is learn as much as I can.	80	20	0	0	0
It is important to me that I improve my science and/or engineering skills this year.	85	13	0	2	0
Even if the science and/or engineering course work is hard, I can learn it.	62	33	4	0	0
Performance-oriented goals:					
It's important to me that I look intelligent compared to others in my science and/or engineering classes.	26	41	17	11	4
It's important to me that my professor doesn't think that I know less than others in my science and engineering classes.	41	37	11	7	4

Table 2. *Mentee Perspectives on Studying Engineering, Science, Technology, or Mathematics*

Item Statement	N	%	Level of Agreement
I can relate to people around me in my classes.	31	67	Agree to Strongly Agree
I can succeed in my major curriculum.	43	94	Agree to Strongly Agree
I have a lot in common with other students in my classes.	18	39	Slightly agree to Agree
Someone like me can succeed in a career related to my major.	39	85	Agree to Strongly Agree
The students in my classes share my personal interests.	26	57	Slightly Agree to Strongly Agree
I can succeed in my major while not having to give up participation in my outside interests (e.g., extracurricular activities, family, sports).	32	70	Slightly agree to Strongly Agree
I can relate to people around me in my extracurricular activities.	31	67	Slightly agree to Strongly Agree
I can make friends with people from different backgrounds and/or values.	41	59	Slightly agree to Strongly Agree



Significant positive relationships between mastery goals and feelings of career competency

Someone like me can succeed in a career related to my major and...

- ▶ *even if the science and/or engineering coursework is hard, I can learn it, $r_s(44) = .30, p = .02$*
- ▶ *one of my goals in my science and/or engineering classes is to learn as much as I can, $r_s(44) = .39, p = .003$*
- ▶ *it is important to me that I improve my science and/or engineering skills this year, $r_s(44) = .24, p = .05$.*

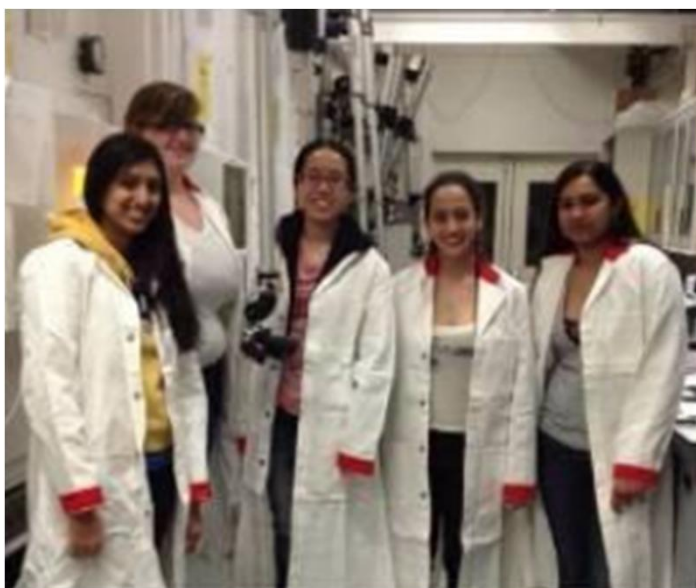


Table 3. Prediction of success in major career for WISE Honors Program Participants.

<i>Model</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>t</i>	<i>p</i>	<i>95%CI</i> <i>LB</i>	<i>95% CI</i> <i>UB</i>
<i>One of my goals in my science and/or engineering classes is to learn as much as I can</i>	.87	.30	.41	2.94*	.005	.27	1.47
<i>It is important to me that I improve my science and/or engineering skills this year</i>	.63	.22	.39	2.85*	.007	.18	1.07

Qualitative Findings

When asked, what do you hope to gain by participating in the mentoring program?

- ▶ Advice/guidance (50%)
- ▶ Relationships/friends/social support (44%)
- ▶ Knowledge (41%)
- ▶ Academic integration (22%)



Mechanical engineering major:

I hope to have guidance through my first year here at Stony Brook and to help me get acclimated to the environment and the rigor of the material.

Biomedical engineering major:

I hope to have met a family of those who share my academic interests, to whom I can go to when I need help in the future.

What qualities do you value in a mentor?



Conclusions

- ▶ Formal peer mentoring encouraged positive social interaction, fostered academic skills, and provided emotional support with academic guidance as peers shared their experiences in a learning community of likeminded women studying science and engineering.
- ▶ Preliminary findings indicate that social constructs, competency beliefs, and mastery oriented achievement goals may be positive predictors of persistence in STEM for first year female students in science and engineering.
- ▶ Undergraduate participation in a first-year mentoring program may lead to increased academic and social integration, which may reduce attrition for students traditionally underrepresented in many STEM fields.
- ▶ University faculty and program advisors may replicate such programs to foster social networks and a sense of belonging in undergraduate women STEM majors.

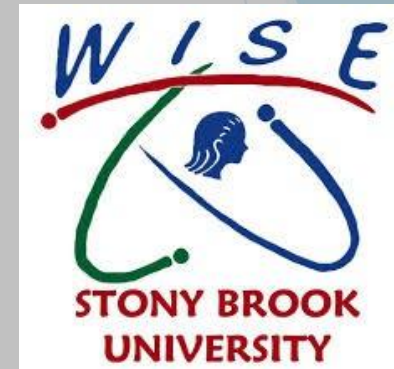
Thank you!

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