Women in Math and Science: Examining Psychological Barriers to Learning

Center for Teaching and Learning Presentation
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Project goals

- examine psychological factors that influence student performance in science and math courses

- use results to develop (steal) teaching tools/techniques

Talk outline

- present survey results
- discuss teaching strategies
- ASK FOR HELP

ID_____

Thoughts and Feelings about Academic Issues

Spring 2007
Agnes Scott College

At beginning and end of class, surveyed 57 students in Spring/Summer 2006 (Chem 102, Math 118, Math 115, Psych 206) (ongoing this year)

Perceptions of the Future (PF). We asked participants how likely it was that they would: 1) pursue a graduate degree in the subject area of the class, and 2) major in the subject area of the class. These items were combined to create an index of future perceptions.

Math and Science Performance. We measured participants' evaluations of their own math and science performance in the class.

> *I am good at math (science) compared to other people in this class.*

Collective Self Esteem (CSE). We used the Private Collective Self-Esteem subscale from Crocker & Luthaten (1989) to measure CSE. We adapted the items so that each item related to participants' gender group. The Collective Self Esteem items measure personal judgments of how good one's gender group is.

Overall, I often feel that being a woman is not worthwhile.

Gender Identification. We used the Importance to Identity subscale from Crocker & Luthaten (1989) to measure gender identification. The items measure the importance of one's gender group to one's self-concept.

I feel that I am like most other women.

Self-Esteem. We measured self-esteem using the 10-item Rosenberg scale of self-esteem.

I feel that I have a number of good qualities.

Emotions. We asked students to report the extent to which they felt various negative (e.g., anger, fear) and positive (e.g., happiness, joy) emotions when thinking about the class.

	not at all		*a little*		*somewhat*		*very*		*extremely*	
guilty	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*guilty*

Gender Stereotypes. Participants were given a list of gender stereotype-relevant words (e.g., emotional, better at verbal skills) and asked to rate the extent to which each word was “more true or men” or “more true of women”. Based on their responses, we created an index of endorsement of stereotypes about women.

		More true of MEN……...……of WOMEN						
1.	Individualistic	-3	-2	-1	0	+1	+2	+3

Semester Grades. Matched anonymously, using unique survey IDs.

Results

- higher levels of self-esteem are associated with less negative emotions and more positive emotions

- more positive evaluation of one's performance is significantly associated with less negative and more positive emotions

- Time 1 collective self-esteem was positively associated with gender identification and self-esteem

- Time 2: same correlations not significant, suggesting some change in the pattern of participants' responses over the semester

Table 1

Intercorrelations Among Variables at Time 1

	Perceptions Future	M/S Perform	CSE	Gender ID	Self-Esteem	Positive Emotions	Negative Emotions	Stereotypes-Women
Perceptions of Future	--							
M/S Performance	.31	--						
Collective Self-Esteem	.13	.28	--					
Gender Identification	.10	.11	**.45****	--				
Self-Esteem	.22	.29	**.64****	**.44****	--			
Positive Emotions	**.40***	**.58****	**.39***	.20	**.47****	--		
Negative Emotions	-.23	**-.43***	**-.56****	-.21	**-.66****	**-.49****	--	
Stereotypes-Women	.12	.17	.05	.13	.14	.19	-.01	--

*$p < .05$. **$p < .01$

Table 2

Intercorrelations Among Variables at Time 2

	Perceptions Future	M/S Perform	CSE	Gender ID	Self-Esteem	Positive Emotions	Negative Emotions	Stereotypes-Women
Perceptions of Future	--							
Math/Science Performance	.10	--						
Collective Self-Esteem	.23	.32	--					
Gender Identification	-.01	.08	.26	--				
Self-Esteem	**.37***	.29	**.52****	.28	--			
Positive Emotions	.23	**.39***	.33	.12	**-.34***	--		
Negative Emotions	-.18	**-.50****	-.09	.11	**.45****	**-.52****	--	
Stereotypes-Women	.28	-.18	-.03	.16	.23	.33	-.02	--

*$p < .05$. **$p < .01$

TIME 1	Perceptions Future	M/S Perform	CSE	Gender ID	Self-Esteem	Positive Emotions	Negative Emotions	Stereotypes-Women
Perceptions of Future	--							
M/S Performance	.31	--						
Collective Self-Esteem	.13	.28	--					
Gender Identification	.10	.11	**.45****	--				
Self-Esteem	.22	.29	**.64****	**.44****	--			
Positive Emotions	**.40***	**.58****	**.39***	.20	**.47****	--		
Negative Emotions	-.23	**-.43***	**-.56****	-.21	**-.66****	**-.49****	--	
Stereotypes-Women	.12	.17	.05	.13	.14	.19	-.01	--

TIME 2	Perceptions Future	M/S Perform	Private CSE	Gender ID	Self-Esteem	Positive Emotions	Negative Emotions	Stereotypes-Women
Perceptions of Future	--							
Math/Science Performance	.10	--						
Collective Self-Esteem	.23	.32	--					
Gender Identification	-.01	.08	.26	--				
Self-Esteem	**.37***	.29	**.52****	.28	--			
Positive Emotions	.23	**.39***	.33	.12	**-.34***	--		
Negative Emotions	-.18	**-.50****	-.09	.11	**.45****	**-.52****	--	
Stereotypes-Women	.28	-.18	-.03	.16	.23	.33	-.02	--

*$p < .05$. **$p < .01$

Differences in variables from Time 1 to Time 2

Table 3: *Means and Standard Deviations of Survey Measures at Time 1 and Time 2*

	Time 1		Time 2	
Measure	Mean	*SD*	Mean	SD
Perceptions of Future	2.63	1.82	2.57	1.91
Math/Science Performance	4.32	1.30	4.22	1.33
Collective Self-Esteem	6.10	1.04	6.00	0.99
Gender Identification	4.62	1.08	4.44	3.32
Self-Esteem	3.79	0.81	3.75	0.83
Positive Emotions	4.15	2.09	3.81	2.15
Negative Emotions	**2.12**	**1.39**	**2.96**	**1.79****
Stereotypes-Women	6.93	4.38	6.33	4.47
Grade	--	--	78.39	13.86

**$p < .01$

Which variables predict final grade?

Table 4: *Regression of Final Grade on Time 1 and Time 2 Independent Variables*

Independent Variable	R^2	β	P
1. Time 1 Negative Emotions	.231*	-.315	*ns*
2. Time 1 Self-Esteem		.206	*ns*

Independent Variable			
1. Time 2 Negative Emotions	.463**	-.645	<.001
2. Time 2 Self-Esteem		.076	*ns*

N =31
*p < .05. **p < .01

Which variables predict desire to continue (PF)?

Time 1 Self-Esteem was a significant predictor of Time 2 PF
Time 1 Math & Science Performance was not

Table 5:
Hierarchical Regression of Time 2 Perception of Future (PF) Scores on Independent Variables

Step/Independent Variable	R^2	R^2 Change	β	*P*
1. Time 1 PF	.603	.603**	.777	<.0001
2. Time 1 Self-Esteem	.669	.066†	.264	.02
Time 1 MS Performance			-.126	*ns*

Betas and p values are from the final regression equation; R2 change and R2s are from the step at which the particular variable entered the equation.
N =34, **p* < .05, ***p* < .01, †*p* < .07

Weaknesses/Future Directions

- small sample (collecting more data now)
- can’t break down by race/ethnicity
- getting to the students late
- experiment with teaching techniques
- group vs. individual self-esteem

Classroom applications

Increased self-esteem leads to better performance?

October 2006: “The nations with the best scores have the least happy, least confident math students, says a study by the Brookings Institution's Brown Center on Education Policy.”

- tutor lower-level students
- easy weekly quizzes/homework
- math/science tutors as role models
- group work
- projects - relate to creative/other interests

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