(How) Do Attitudes of Developmental Students Toward Mathematics Matter?

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Outline

- Explore the psychological foundations of attitude through definitions.
- Present results about the nature of developmental students' attitude toward mathematics from a dissertation study.
- Open discussion to examine the implications for instruction and learning.

What Is Attitude?

- A learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object (Fishbein & Ajzen, 1975).
- A psychological construct (Mueller, 1986).
- Psychological tendency expressed by an individual in the evaluation of an entity through cognitive, affective, and behavioral responses with some degree of favor or disfavor (Eagly & Chaiken,1993).
- Examples: attitude toward religion, attitude toward public transport.

Measuring Attitude:
Indirect and Direct Methods

- **Indirect Methods:** Infer from responses and behavior towards objects, e.g., performance of behavior that appears relevant to an attitude (Petty & Cacioppo, 1996).

- **Direct Methods:** Use psychometric scales, e.g., Thurstone, Likert, and Semantic Differential scales (Petty & Cacioppo, 1996).

The Fennema-Sherman Mathematics Attitude Scale

- A Likert-scale questionnaire to measure attitude with established reliability and validity.

- Domains that constitute attitude: (1) Success, (2) Male domain, (3) Teacher, (4) Confidence, (5) Anxiety, (6) Usefulness, (7) Effectance motivation, (8) Father, (9) Mother.

- The study used the first 7 domains.

Fennema-Sherman Domain 1

Success
I’d be proud to be the outstanding student in mathematics.
Winning a prize in mathematics would make me feel unpleasantly conspicuous.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 1

Success	M	SD
I'd be proud to be the outstanding student in mathematics.	4.43	0.698
Winning a prize in mathematics would make me feel unpleasantly conspicuous.	3.93	0.923
All items	4.24	0.554

Fennema-Sherman Domain 2

Male Domain
Males are not naturally better than females in mathematics.
It’s hard to believe a female could be a genius in mathematics.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 2

Male Domain	M	SD
Males are not naturally better than females in mathematics.	3.45	1.384
It's hard to believe a female could be a genius in mathematics.	4.62	0.660
All items	4.34	0.556

Fennema-Sherman Domain 3

Teacher
My teachers think I’m the kind of person who could do well in mathematics.
My teachers think advanced math is a waste of time for me.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 3

Teacher	M	SD
My teachers think I'm the kind of person who could do well in mathematics.	3.46	0.853
My teachers think advanced math is a waste of time for me.	3.85	0.833
All items	3.74	0.589

Fennema-Sherman Domain 4

Confidence
I have a lot of self confidence when it comes to mathematics.
I’m not the type to do well in math.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 4

Confidence	M	SD
I have a lot of self confidence when it comes to mathematics.	3.01	1.087
I'm not the type to do well in math.	3.28	1.165
All items	3.27	0.855

Fennema-Sherman Domain 5

Anxiety
Math doesn’t scare me at all.
Mathematics usually makes me feel uncomfortable and nervous.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 5

Anxiety	**M**	**SD**
Math doesn’t scare me at all.	2.87	1.125
Mathematics usually makes me feel uncomfortable and nervous.	3.06	1.202
All items	2.97	0.894

Fennema-Sherman Domain 6

Usefulness
I study mathematics because I know how useful it is.
Mathematics is of no relevance to my life.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 6

Usefulness	**M**	**SD**
I study mathematics because I know how useful it is.	3.47	1.003
Mathematics is of no relevance to my life.	3.87	0.919
All items	3.73	0.794

Fennema-Sherman Domain 7

Effectance Motivation
When a math problem arises that I can’t immediately solve, I stick with it until I have the solution.
I don't understand how some people can spend so much time on math and seem to enjoy it.

1 = strongly disagree
5 = strongly agree

Mean (M) and Standard Deviations (SD) of the Selected Questions for Domain 7

Effectance Motivation	**M**	**SD**
When a math problem arises that I can't immediately solve, I stick with it until I have the solution.	3.34	0.983
I don't understand how some people can spend so much time on math and seem to enjoy it.	3.25	1.117
All items	3.14	0.75

Mean (M) and Standard Deviations (SD) of the Overall 7 Domains

Overall	M	SD
All items	3.68	0.510

Questions to Ponder

- How do you determine the learning needs of students in your developmental mathematics classes?
- How would you describe the attitude of students you teach in your developmental mathematics classes?
- How are learning needs and attitude related?

Main Research Questions (Abridged)

1. Do differences exist in the attitudes toward mathematics of developmental mathematics students among rural, urban, and suburban community colleges by gender?

2. Is there any association between locale, socioeconomic status, and race/ethnicity?

Final Research Question (Abridged)

3. Do key demographic variables such as gender, age, ethnicity, attendance status, and number of high school mathematics credits predict students' perception of mathematically intensive careers?

Results: Question 1

- There were no statistically significant differences in the overall attitude or the component attitudes toward mathematics by gender and by locale. Statistical significance was set at $p < .05$.

- That is, regardless of gender and locale, the attitudes of developmental students toward mathematics were similar.

Results: Question 2

- There was a statistically significant association between locale and reported socio-economic status. That is, the higher responses on each socioeconomic status from the suburban students did not occur by chance.

	Annual	Household	Income		$p < .001$
	<$40K	**$40K - $80K**	**≥ $80K**		**Total**
Rural	29	12	2		**43**
Suburban	76	61	20		**157**
Urban	66	16	4		**86**
Total	**171**	**89**	**26**		**286**

Results: Question 2 (cont'd.)

- Variance in socioeconomic status is statistically significant across reported ethnicity

  ($p < .001$).

Results: Question 3

- Attendance status was the only statistically significant predictor of perception of mathematically intensive careers (p = .007).

- That is, part-time students who enrolled in developmental mathematics in community colleges are 2.5 times more likely than full-time students to have low perception of mathematically intensive careers.

Estimated Marginal Means, Standard Errors, and 95% CIs of Overall Attitude

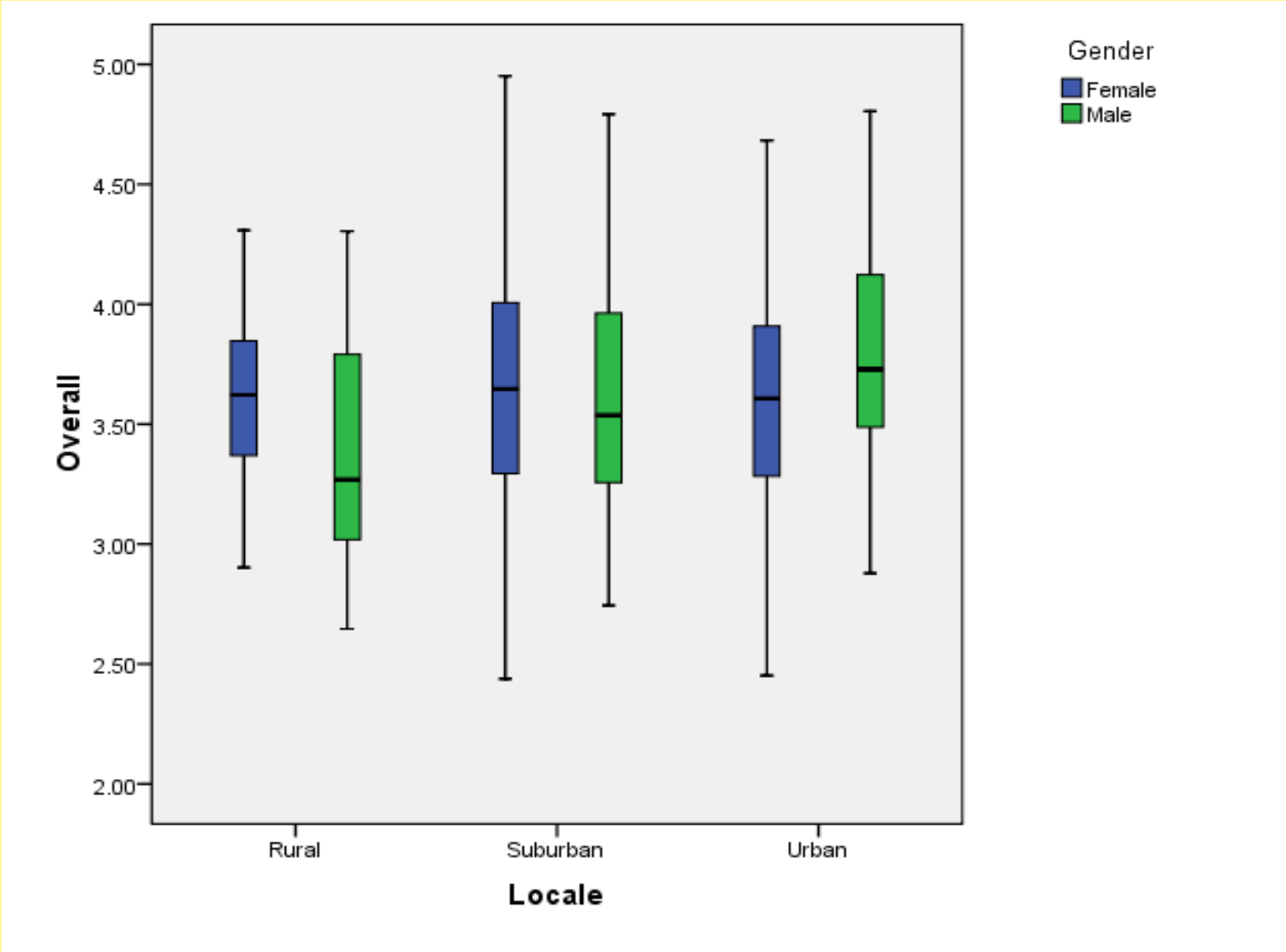
	M	*SE*	95% Confidence Interval
Locale			
Rural	3.520	.085	(3.353, 3.686)
Suburban	3.647	.043	(3.562, 3.732)
Urban	3.719	.058	(3.605, 3.832)
Gender			
Female	3.648	.038	(3.573, 3.723)
Male	3.608	.063	(3.484, 3.734)

What Did the Estimated Marginal Means Show?

- The estimated marginal means of overall attitude were greater than 3 for locale and gender respectively. Values less than 3 denote negative attitude, values greater than 3 positive, and values equal to 3 indifference.

- The 95% confidence intervals did not contain 3, hence the students reported positive attitudes.

Box-Plots of Overall Attitude by Locale and Gender



Learning Theories and Attitude

- No single theory of learning is capable of explaining human learning (Phillips & Soltis, 2004).

- Human learning is complex (Gredler, 2005).

- How can the theories of Skinner, Piaget, Vygotsky, Bronfenbrenner, Bruner, Dewey, Gagné, Gadner, Bandura, etc. help us to better understand attitude and its role in instruction and learning?

Learning Theories and Attitude (cont'd.)

- How do we situate student attitudes within the Behaviorist, Constructivist, Structure of the Disciplines, Motivation, Learning Style, and Multiple Intelligences learning theoretical frameworks espoused by the respective learning theorists previously mentioned?

Questions for Discussion

- How do you determine the learning needs of students in your developmental mathematics classes?
- How would you describe the attitude of students you teach in your developmental mathematics classes?
- How are learning needs and attitude related?

Key References

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