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# Factors Impacting Students' Mathematical Performance and Beliefs

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# Factors Impacting Students' Mathematical Performance & Beliefs

**Lauren Falck, Alexis Steinlage,  
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Department of Mathematics

## Questions/Background

Our data comes from a study of elementary education majors. The larger study investigated their mathematical knowledge and beliefs about mathematics and teaching/learning mathematics. After coding student strategies for each mathematical task and analyzing their mathographies, we were interested to see if there was a connection between students' beliefs about mathematics, mathematics learning, and performance on different mathematics tasks.

We looked for a relationship between:

- Students Preference of Mathematics Subjects & Student Performance
- Student Preference of Teachers & Student Preference of Mathematics Subjects
- Student Preference of Teachers & Qualities of Teachers

Prior to our study, many researchers had focused on the level of mathematical understanding of preservice teachers and how their understanding was similar to those of K-12 students. We were looking for how preservice teachers' beliefs impacted their performance and what impacted their beliefs. As future teachers, we were also interested in looking for research that can be applicable for bettering the classroom experience of students.

Research Questions:

- How do elementary education majors perform according to their likes and dislikes of particular mathematics subjects?
- How much of an impact do teachers have on whether a student likes or dislikes a particular mathematics subject?
- What qualities do students see in their favorite and least favorite teachers?

## Methods

**Sample:** 23 Math Reasoning I Students  
48 Math Reasoning III Students

**Data:** 7 assessment tasks at the end of the course:  
Math Reasoning I - three fraction tasks.  
Math Reasoning III - two measurement task and two geometry tasks.  
Mathographies:  
Essays on beliefs about mathematics learning/teaching

Assessments and mathographies were given within a similar time frame.

**Data Analysis:**

### Codes for Assessment Tasks

99	Blank
999	Nonsensical/Irrelevant
100	Misconception
300/400	Partial Understanding
500	Procedural Understanding
600	Conceptual Understanding

Coding student strategies helped us analyze what their general level of understanding was in the topic areas of measurement, geometry, and fractions.

### Codes for Mathographies

Likes/Dislikes Math Subjects
Favorite/Least Favorite Teachers

Coding student responses allowed us to see if their like or dislike of certain mathematics subjects had an impact on how they performed on the assessment tasks.

## Conclusion

**After categorizing students on each task and reading their mathographies, we were able to conclude:**

- We found that if a student likes the particular mathematics subject, they tended to perform better on the tasks within that particular subject compared to those who disliked that particular mathematics subject. The inverse of this relationship will also stand.
- Implication for relationship between students' preference of teacher and students' preference of mathematics subject.
- Implications that favorite teachers have similar qualities and least favorite teachers have similar qualities.

**Questions that remain:**

- How could further research validate the relationship between preference of mathematics subject and level of understanding?
- How could further research validate the relationship between students' preference of teacher and students' preference of mathematics subject?
- Do teachers impact what mathematics subjects students like or do the mathematics subjects impact student preference of teachers?
- How can teaching programs implement development on favorite teacher qualities?

## Resources

- Bal, A. P. (2015). Examination of the Mathematical Problem-Solving Beliefs and Success Levels of Primary School Teacher Candidates Through the Variables of Mathematical Success and Gender. *Educational Sciences: Theory & Practice*, 15(5), 1-18.
- Benbow, R. M. (1993). Tracing Mathematical Beliefs of Preservice Teachers through Integrated Content-Methods Courses. *Education Resources Information Center*, 1-32.
- Briley, J. S. (2012). The Relationships Among Mathematics Teaching Efficacy, Mathematics Self-Efficacy, and Mathematical Beliefs for Elementary Pre-Service Teachers. *The Journal*, 5(Teacher Attributes).
- Cai, J. (Eds.). (2017). *Compendium for Research in Mathematics Education*. Reston, VA: National Council of Teachers of Mathematics.
- Linsell, C., Anakin, M. (2012). Diagnostic Assessment of Pre-Service Teachers' Mathematical Content Knowledge. *Mathematics Teacher Education and Development*, 14(2).
- Paolucci, C. (2015). Changing Perspectives: Examining the Potential for Advanced Mathematical Studies to Influence Pre-service Teachers' Beliefs About Mathematics. *Elsevier*, 97-107. Retrieved from <http://dx.doi.org/10.1016/j.tate.2015.03.002>
- Schonefeld, A. H. (1989). Explorations of Students' Mathematical Beliefs and Behavior. *Journal for Research in Mathematics Education*, 20(4), 338-355.
- Yavuz, G., Erbay, H. (2015). The Analysis of Pre-service Teachers' Beliefs About Mathematical Problem Solving. *Elsevier*, 2688-2692.

## Results

### Students' Performance on Mathematic Subjects According to Preference

#### Fraction

R1s19-1	Correct-Correct- Correct				Correct-Correct- Partial				Correct- Partial-Partial				Partial-Partial- Partial			
	03	05	08	11	14	20	21	23	04	10	13	15				
	16	19	30	35	26	27	32	33	18	25	28					
								34								

#### Measurement

R3s19-1	Correct-Correct			Correct-Partial			Partial-Partial			Correct-Wrong			Wrong-Partial			Wrong-Wrong		
	9	12	24	1	4	7	21			9	13	20	2	3	17	8	16	18
				26						25	29	31				27	28	30
										35								

R3s19-2	Correct-Correct			Correct-Partial			Partial-Partial			Correct-Wrong			Wrong-Partial			Wrong-Wrong		
	1	19	26	14	18	30				4	6	7	8	25	36	10	20	21
										13	17	23	34					
										32	35							

#### Geometry

R3s19-1	Correct-Correct			Correct-Partial			Partial-Partial			Correct-Wrong			Wrong-Partial			Wrong-Wrong		
	8			7	20	24	26	3	9	6	18	21	22	1	2	4	12	
				29						25			13	16	17	19		
													27	28	30	31		

R3s19-2	Correct-Correct			Correct-Partial			Partial-Partial			Correct-Wrong			Wrong-Partial			Wrong-Wrong		
	1	26	35	8	24					4	10	13	17	6	7	14	20	
										13	17	23	34					
										30	32	37						

We coded each student strategies as correct, partially correct, or incorrect.

- 500 and 600 correct strategy
- 300 partially correct strategy
- 99, 999, and 100 incorrect strategy

The table represents a gradient from highest level of understanding on the left and the lowest level of understanding on the right. Each cell contains the ID number of the student. The color of the box represents their likes or dislikes of the particular mathematics subject. The title of each column represents how the student strategy scored on each task.

Yellow	Like that particular mathematics subject
Orange	Neutral feelings about that particular mathematics subject
Red	Do not like that particular mathematics subject
White	Did not submit a mathography

**Results:**

The ratio of yellow cells to red cells on the left side of the table is higher than the ratio on the right side of the table. This indicates that if the student likes the particular mathematics subject, they tended to perform better on the tasks within that particular subject compared to those who disliked that particular mathematics subject. The inverse of this relationship will also stand.

### Relationship Between Students' Preference of Teachers and Preference of Mathematics Subject

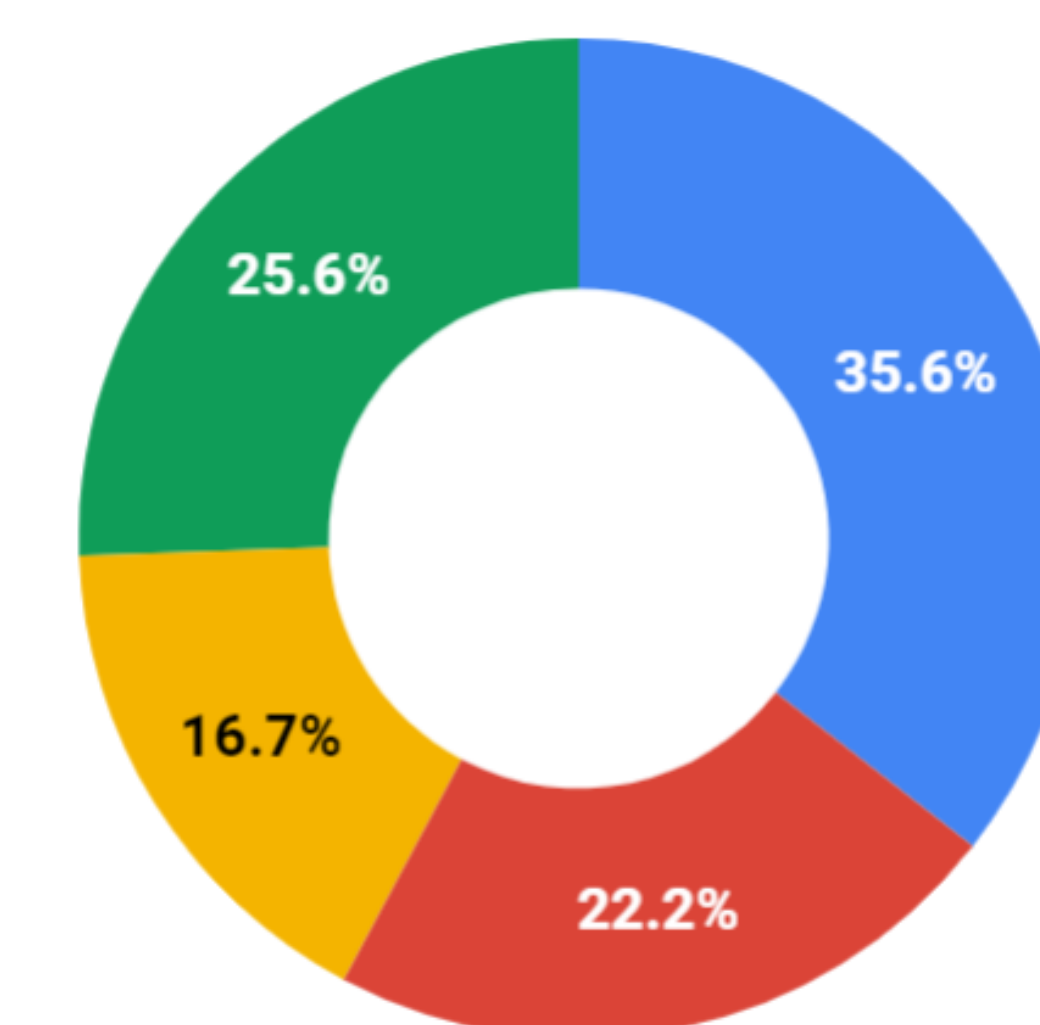
We coded each students' mathography by seeing who were their favorite and least favorite teachers and which mathematics subjects they liked or disliked. The donut chart to the right shows the relationship between students' preference of teacher and preference of mathematics subject.

- Orange is lacking information
- Green is lacking relationship between teacher & subject
- Red is relationship between least favorite teacher & least favorite subject
- Blue is relationship between favorite teacher & favorite subject

**Results:**

We noticed that there was a connection between whether the student liked or disliked a specific mathematics subject and whether the student liked or disliked the teacher of that subject.

- 57.8% of students in our study experienced either their favorite teacher taught their favorite mathematics subject or their least favorite teacher taught their least favorite mathematics subject.
- 25.6% of students in our study did not have this relationship present
- 16.7% of students in our study did not give enough information in their mathographies for us to make a claim.



- Lacking Info.
- No Relationship
- Least Favorite
- Favorite

### Qualities of Favorite and Least Favorite Teachers

After analyzing the relationship between students' preference of teacher and students' preference of mathematics subject, we wondered what characteristics students' saw in their favorite and least favorite teachers. We grouped these characteristics of teachers from students' mathographies and organized them from most common to least common characteristics in the lists below.

**Favorite Teacher Qualities:**

- Explain material well
- Took extra time to help
- Cared about mathematics and students' personal lives
- Made learning fun even when the material is boring
- Interactive learning
- Dedicated and passionate about teaching
- Applied the mathematics to real-life situations
- Patient when students were struggling

**Least Favorite Teacher Qualities:**

- The method of teaching ~ not interactive
- Not good at helping those who struggled
- Didn't seem to care about teaching or the students
- Students had to teach themselves
- Stressful environments/classroom for the students
- Degraded students
- Made learning not fun
- Lacked explanations/wasn't able to answer questions

**Results:**

Favorite teacher qualities have a common theme and least favorite teachers have a common theme. There are no commonalities amongst favorite and least favorite teacher qualities.