

Feb 21st, 11:30 AM - 1:30 PM

## Teaching Social Justice Issues Through Mathematics Curriculum

Lydia L. Butters

University of Northern Iowa, [buttelab@uni.edu](mailto:buttelab@uni.edu)

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### Recommended Citation

Butters, Lydia L., "Teaching Social Justice Issues Through Mathematics Curriculum" (2022). *Research in the Capitol*. 13.

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# Teaching Social Justice Issues Through Mathematics Curriculum

Lydia Butters Undergraduate Student  
University of Northern Iowa

## Abstract

Learning about the social injustices diverse individuals face can be implemented into formal education, specifically mathematics instruction. Further, creating meaningful and relevant experiences for students in mathematics is essential. When students are provided opportunities to pose questions relevant to their lives, contest injustices, and challenge how the world is shaped, the true utility of mathematics becomes visible, and students can be active parts of the solution (Bush, 2019). My research consists of lessons from the textbook, *High School Mathematics Lessons to Explore, Understand and Respond to Social Injustice* (Berry et al., 2020) with revisions based on the interests and needs of my students (e.g. food deserts in the Midwest and ACT scores). Three lessons were taught in a statistics course at an urban high school in the Midwest, while two other lessons were conducted in a geometry content course for pre-service K-8 teachers at a Midwestern University. Overall, high school students showed growth in their understanding of social justice issues and the uses of mathematics. While pre-service teachers also showed growth in their understanding of social justice issues and the uses of mathematics; they also acquired the ability to make more specific claims.

## Background

- Mathematics is a tool that can be used to help students analyze social justice issues (Bush, 2019).
- Creating meaningful and relevant experiences for students in mathematics is essential. When students are provided opportunities to pose questions relevant to their lives, contest injustices, and challenge how the world is shaped, the true utility of mathematics becomes visible, and students are active parts of the solution (Bush, 2019).
- Teaching social justice through mathematics is part of a more equitable mathematics curriculum (Bush, 2019).
- Further, preservice teachers would benefit from exploring social justice mathematics tasks as part of their preparation for using such tasks in their future classrooms (Appova & Garil, 2013).

## Question

How does teaching mathematics through a social justice lens alter K-12 students' and preservice elementary teachers' understanding of mathematics' uses and their knowledge of issues concerning society?

## Methods

### Participants:

15 high school students at an urban high school—enrolled in Statistics  
18 undergraduate preservice elementary majors enrolled in a geometry content course for future K-8 teachers

### Data Sources:

Pre-post survey consisting of multiple choice and short answer questions were given for each lesson taught to all students.

Questions included knowledge of social justice topics and math topics  
Multi-cultural disposition survey using a likert scale was given twice -- prior to and after all lessons

## Data Analysis

Key name/codes were created for short answer responses to find themes  
For multiple choice/likert scale – percentages were used

## Results

**Main Claim – High School Students:** High school students showed **growth** in their understanding and perspectives of social justice issues through exploration with math.

**Incarceration lesson:** Exploring Incarceration rates among different races in the United States

Race/Ethnicity	Percent of Total US Population	Percent of US Prison Population	Race/Ethnicity	Percent of Population Incarcerated
white	61.3	39.0	white	.45%
Black/African American	13.3	40.0	Black/African American	2.1%
Hispanic/Latinx	17.8	19.0	Hispanic/Latinx	.76%
Asian	5.7	1.2	Asian	.099%
Other	1.9	0.8	Other	.3%

Source: Berry et al (2020)

Table 1. Pre-Post Survey Results on Student Beliefs Related to Incarceration Rates

	Pre-survey	Post-survey
Black people are incarcerated at higher rates than other racial groups	3/10 (30%)	9/11 (82%)
The differing racial groups (white, Hispanic, black, Asian, pacific islanders, etc.) are incarcerated at different rates; the incarceration rates are unequal	7/10 (70%)	9/11 (82%)

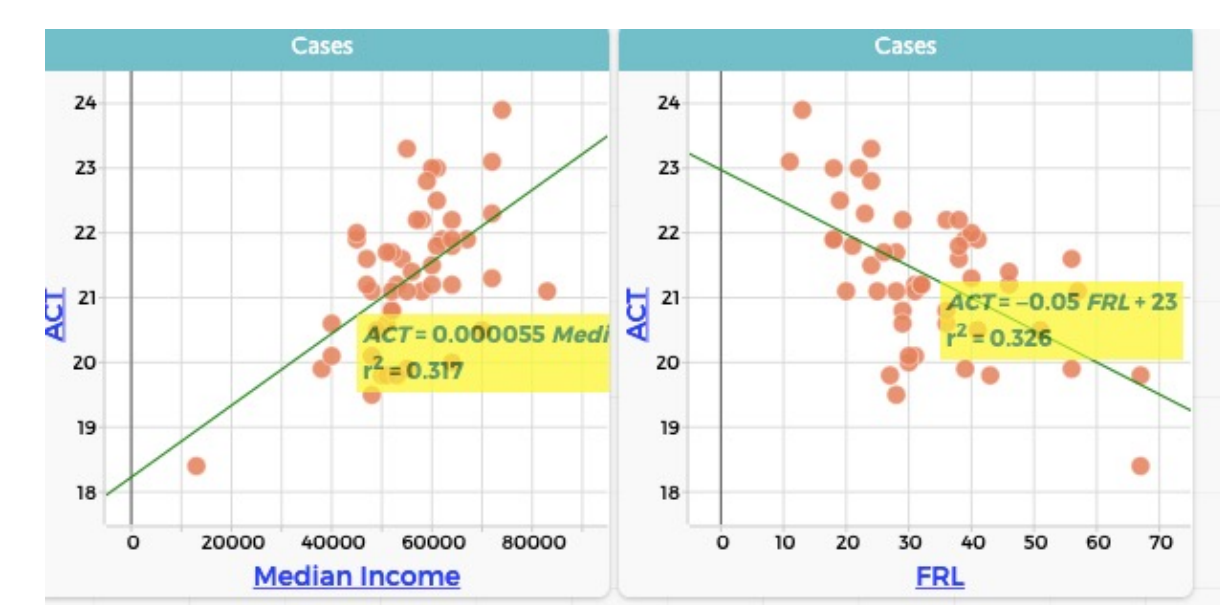
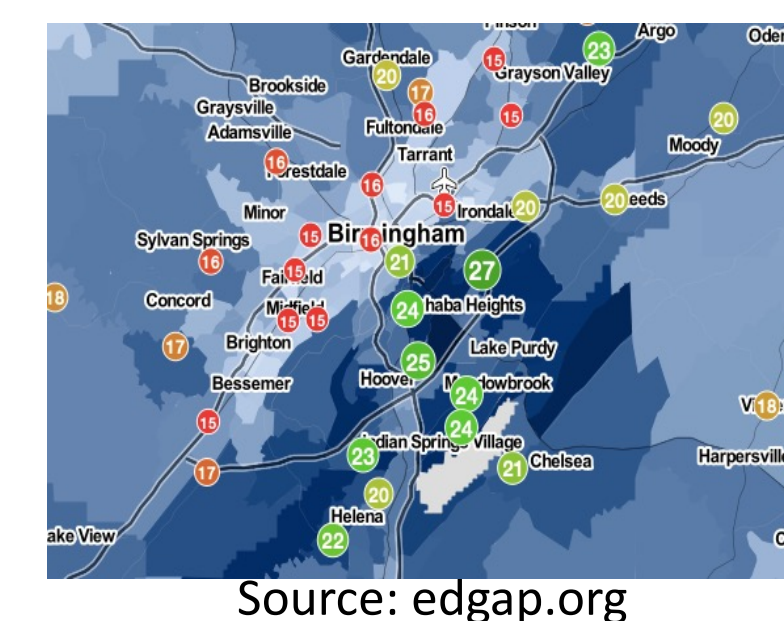
**Sub-claim:** After the lesson, 66% (6/11) students stated that discrimination/racism is prevalent in American society.

**“There is an unfairness involved in the law system when it comes to different races and jail time.”**

**ACT Score Lesson:** Exploring the relationship between ACT scores and median household income and free and reduced lunch percentage using linear regressions and the edGap Map

Table 2. ACT score vs. Median Household Income

ACT Score vs. Median Household Income	Positive linear correlation between ACT score and median household income
Pre-survey	2/7 (29%)
Post-survey	6/9 (66.67%)



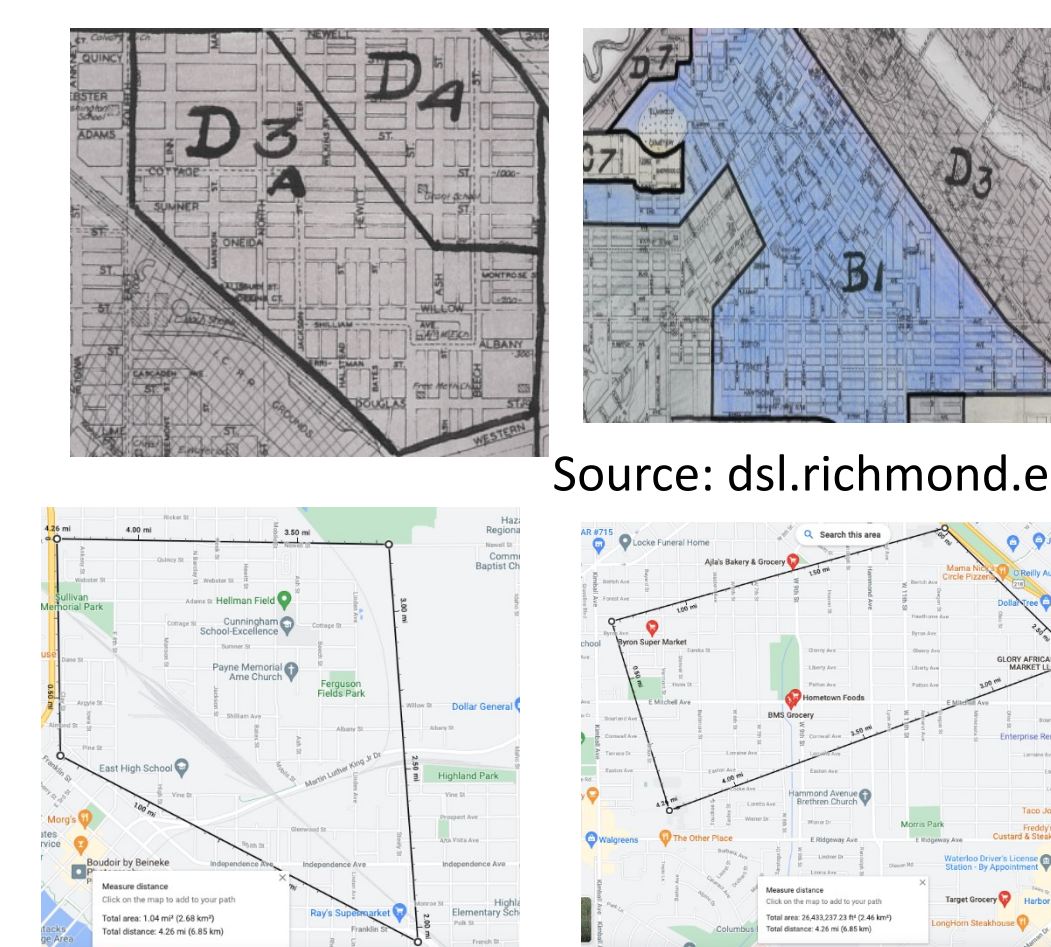
**“There’s a correlation because the higher your income the higher your ACT score will be. Then the higher the free and reduced lunch the lower the act score.”**

**Main Claim – Preservice Teachers:** College students showed **growth** in their understanding and perspectives on social justice issues and mathematics’ uses through exploration with math. They were able to make broader inferences on American society based on the mathematics they conducted.

**Food Injustices/Deserts:** Exploring food deserts and redlining in the Midwest and Texas with geometry

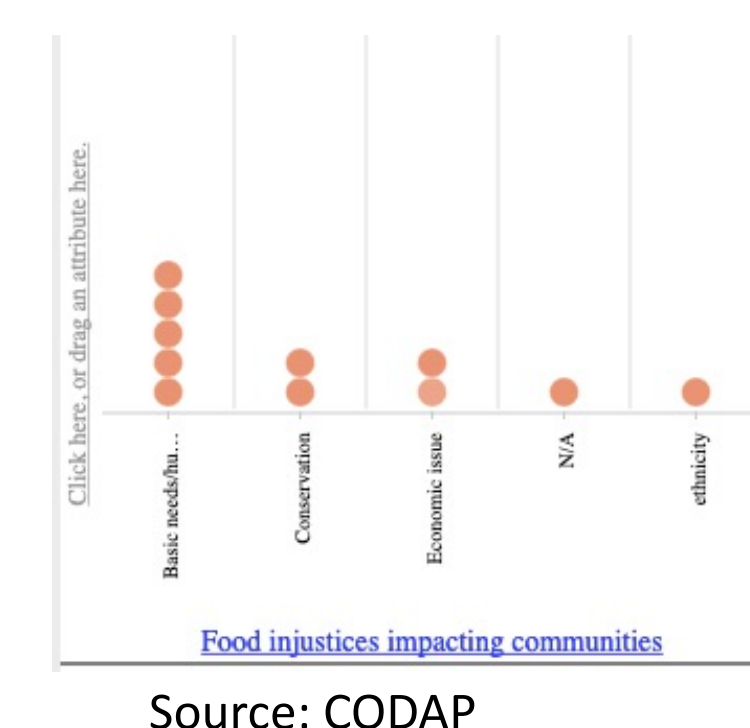
Table 3. Is there a Connection Between Redlined Areas and Food Deserts?

	There’s a connection between redlined areas and food deserts	Redlined areas correlate to less access to nutritious foods
Pre-survey	6/13 (46%)	5/12 (42%)
Post-Survey	12/12 (100%)	5/6 (83%)



**“Areas that are deemed at risk or hazardous are more often food deserts than the areas that are deemed desirable.”**

**Students concerned that food deserts are an example of an infringement upon human rights:**



**“Given that we in one of the richest countries in the world, I feel like food injustices shouldn’t be present, as we should be taking action to amend the food inequalities experienced here. Communities that are poorer should be assisted in obtaining food, not punished in the sense of creating an even greater food disparity.”**

**“I believe that basic needs should be met regardless of race, culture, religion, sex or gender orientation. That being said, communities, regardless of which one they identify with, should have the basic need of food and good nutrition met.”**

One student addressed the main underlying issue of food deserts:

**“It is terrible and makes me very sad, what is the solution? More grocery stores...I believe it all comes back to the redlining.”**

**Mathematical classification of a food desert:**

**“areas where greater than 30% of houses are more than 10 miles away from an affordable grocery store would be considered a food desert.”**

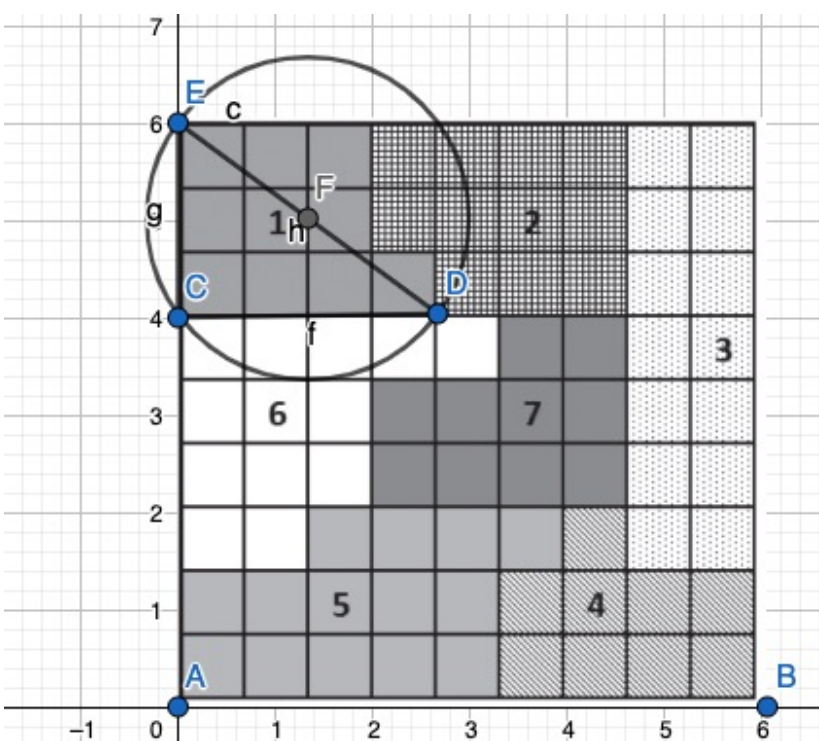
**Gerrymandering –** Exploring gerrymandering with geometry using Reock Ratios and Polsby Popper Test (PPS Test)

**100% of students agreed that we should use math to determine if voting is fair, when asked**

**“Yes, because it can make a more fair process by making the districts more representative of their states.”**

Table 4. If something is more compact, is it more fair, less fair, neither?

Compact = Fair	Less fair	More Fair
Pre-survey	5/7 (71%)	0/7 (0%)
Post-survey	1/8 (13%)	6/8 (75%)



## Conclusions

- Policy changes students implied over all lessons: do more with housing, eliminate ACT test, reform law system, and use mathematics to analyze gerrymandering.
- Overall perspective changes: Students realized there are structural issues within society which make aspects of life unfair for minorities and/or working-class individuals, such as redlining and gerrymandering.
- Devalue ACT test because scores may depend on external factors rather than intelligence, as they found a positive linear correlation with median household income and ACT score, and a negative linear correlation with FRL % and ACT score.
- Maybe by looking at overall GPA instead of ACT score this wouldn’t exclude marginalized students from gaining bachelor’s degrees and beyond as much as it does. This is a research question for another time.
- There was not a significant change in students’ social perspectives based on the pre and post survey from the multicultural index. In order to conclude if students’ overall social/multicultural perspective changed, more research needs to be done, over a longer time frame.
- Overall, students became more knowledgeable of social injustices using mathematics and were able to use mathematics in a way which was different from traditional methods to explore those injustices.
- Given the activities students explored, they were all able to make broad claims about the specific social justice issues explored, while the preservice teachers analyzed solutions to these social injustices and sought after breaking the status quo.
- In a post-survey given to college students, 7/8 (87.5%) of students were interested in incorporating social justice issues into their mathematics curriculum in their future classrooms. Therefore, more courses on TMSJ(Teaching Mathematics through Social Justice) should be implemented into universities/colleges.

## Citations & Acknowledgements

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 Acknowledgments:  
 The Mathematics Teacher: Learning and Teaching PK-12 for inspiration  
 Dr. Heather Gallivan for her immense amount of knowledge and support throughout this project