From the Courtroom to the Classroom: Gerrymandering and Mathematics Education

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Fitchburg State University

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Overview

1. Motivation and Goals

2. Spring 2018: Math 1030Q (UConn)
   - “Diving In”

3. Fall 2018: Math 114 (Trinity)
   - “Transitions”

4. Spring 2019: Math 114 (Trinity)
   - “Fine Tuning”

5. Fall 2019: Math/Pols 128 (Trinity)
   - “Center Stage”
Motivation and Goals

Framework

Quantitative Literacy (QL)

- “...an ability to choose and apply mathematical concepts in specific life and work situations that involve quantitative information” (MSU)

Social Justice Mathematics (TMfSJ)

- “…learners make sense of data in ways that help them see the humanity behind the numbers and to use mathematics as a tool for exposing and analyzing injustices in society…” (Gutiérrez, 2013)
Motivation and Goals

Goals and Context

Overarching Goals/Ideas
- Mathematics exists in a sociopolitical context.
- Mathematics can be used subjectively.
- Students should leave college as informed citizens.

General Education Math Courses
- “When is this actually used?”
- Reduce math anxiety and shift disposition towards subject
- *Last formal mathematics course!*
Motivation and Goals

(Benisek v. Lamone)
(A generally accepted map)
Further Motivation

mggg.org (based at Tufts)
Further Motivation

The Calendar

2020 – U.S. Census

2021-2022 – Next redistricting cycle
Math 1030Q: Elementary Discrete Mathematics (UConn)

- Akin to “Great Ideas in Mathematics”
- General education course satisfying quantitative (Q) requirement
- 3 sections among 2 instructors, 85 total students

“Project” Components

- 4-5 weeks of class
- Groups of 3-4 students
- Group portions and individual portions
- Mathematical content and sociopolitical content
Main Themes/Components of the Project

(1) How do students’ respond over time to mathematics being situated in a social justice and/or political context?

- “Privilege and Oppression in Math Ed” (blog post) by Felton-Koestler
- YouTube video on racial and partisan gerrymandering
- ACLU document on the Voting Rights Act (minority vote dilution)
- Chronicle article on Moon Duchin’s work with the MGGG

**Student Comment:** “I was a little surprised by the claim that Mathematics operates in Whiteness because I had never previously heard or thought of mathematics as being something along racial lines.”

**Student Comment:** “Another thing I learned from doing this project was how easy it is for math to touch all aspects of our world and society, in places you would never expect.”
Main Themes/Components of the Project

(2) How do students (individual and group) respond over time to mathematics being used as a tool in subjective ways (e.g. the idea of “fairness” with regard to redistricting)?

- Simplified grid models for redistricting
- Exploration of various CT redistrictings using CT map, population data, and FiveThirtyEight (synthesize numerical and geometric information)
- Efficiency gap computations
- “The Supreme Court is Allergic to Math” (FiveThirtyEight)

Student Comment: “I remember how we had to decide which map was most fair and even in the simplest form we had to discuss our opinions and come together to make a decision.”
Simple Grid Example

**Question:** Create a map containing 5 districts which is:

(a) Gerrymandered for Stars (29 on grid)
(b) Gerrymandered for Diamonds (21 on grid)
(c) The “most fair” map (according to you and/or your group)
Instructor and Student Thoughts

**Student Survey:** 88% claimed that they learned more in the unit than in other course content and 78% claimed that they enjoyed the unit more than the other course content (74/85 students responded).

**Instructor thoughts:**
- Make a natural part of the course
- Increase authenticity (use of applet)
- Moving students from consumers to producers
- Increase mathematical rigor (compactness tests)
- Course theme of subjectivity of mathematics in reality
Let’s Apply What I Learned

(UConn → Trinity)

Math 114: Judgment and Decision Making

- General education course, satisfies Numerical distribution requirement
- 30 students, all upperclassmen, wide range of majors

Course Goal: Use politics as the theme tying together existing topics such as Voting Theory and Apportionment Theory while adding Writing Assignments and a modified Redistricting/Gerrymandering unit.
Redistricting/Gerrymandering Unit

Course Notes

- Redistricting principles, strategies, and goals
- Examples using simple and weighted grids
- Efficiency Gap (and Modified Efficiency Gap)
- Compactness tests on simple and “constrained” grids
  (Polsby-Popper, Reock, Convex Hull)
- Prison Gerrymandering writing assignment

NAACP Sues Connecticut Over 'Prison Gerrymandering'

The lawsuit, filed June 28, 2018, in the U.S. District Court for the District of Connecticut, is the first statewide challenge to the practice of counting prisoners as residents of the state legislative districts where they are incarcerated instead of in their home districts.
Weighted Grid Example
"Constrained" Grid Example
Redistricting/Gerrymandering Unit

Group Project

- Serve as Redistricting Commission solving the problem presented by controversial congressional district maps (MD, NC, OH, MI)
  - 10 groups of 3 students each, assigned roles of Mathematician, Political Scientist, and Critical Race Scholar

- Create map using Dave’s Redistricting App
  - Satisfy conditions of equal populations, contiguous, proportional representation, abide by the Voting Rights Act, fairly compact

- Research and write a Proposal Report (template provided)
  - Components include calculations (and their context), the state’s redistricting process, court cases, social justice issues, etc.
Maryland Map Proposals

(Current Map)
Let’s Try to Make Some Adjustments

Math 114: “Mathematics and Politics” - an unofficial course rebrand with the four main topics of Voting Theory, Apportionment Theory, Redistricting, and Game Theory.

Project changes:
- Ability to choose (with justification) any state
- DRA 2020
- Removal of individual roles
- Removal of report template
- Individual assessment before project
- (Slightly) increase authenticity
- Timing during the semester
Let’s Make This an Entire Course

Math/Pols 128: Mathematics and Redistricting (Fall 2019)
- Listed under Mathematics, Political Science, Public Policy & Law, Community Learning
- 19 students, permission-only (completed a survey)
- Community Partner: Connecticut House Democrats

Proposed content goals:
- U.S. Census administration and data analysis
- Election forecasting
- Redistricting legal history
- Compactness metrics
- Prison gerrymandering in Connecticut

Suggestions and contacts are welcome!
Concluding Thoughts

Returning to Goals

1. Mathematics exists in a sociopolitical context.
   – offers a theme for general education courses

2. Mathematics can be used subjectively.
   – change the mindset of “one right answer” or “one right method”

3. Students should leave college as informed citizens.
   – authenticity has the ability to create meaningful educational experiences (especially with community partnerships)
   – often last formal experience with mathematics
Supreme Court halts gerrymandering cases in Ohio and Michigan

MAY 24, 2019

The Supreme Court agreed Friday to put on hold partisan gerrymandering cases from Ohio and Michigan, temporarily sparing Republican lawmakers in those states of the need to redraw congressional districts by the summer.

The high court’s emergency order came as no surprise. The justices are weighing partisan gerrymandering cases from North Carolina and Maryland, and are expected to hand down rulings by the end of June. At issue is whether state lawmakers violate the Constitution if they drew an electoral map to entrench their party in power.
Thank You!

- Adam Giambrone - collaborator
- Mathematics departments at UConn and Trinity
- Jack Dougherty & Megan Hartline - Community Learning @ Trinity
- Connecticut General Assembly

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“I think one of the biggest things I got out of this group assignment was the capacity to understand the relationship between math and Supreme Court cases, which I would have never been slightly interested in before this project. Gerrymandering wasn’t even a term that crossed my mind or something I had heard of, and I’m extremely grateful to be somewhat educated on it now. Not only that, but I learned how math and what we have done in class actually applies to real life scenarios that can potentially directly affect me. Math has never been something that I enjoyed or thought I would apply to myself and my personal life, but this assignment has taught me otherwise.”