"When Are We Going to Use Math to Actually Make Change?" A Social Justice Routine for the Mathematics Classroom

Eric Fishman

Abstract

This article describes the development and implementation of a social justice warm-up routine for the mathematics classroom. In this routine, students are presented with data and are then asked to answer a question that begins with: "Is it fair that …?" I discuss how I used this routine with my 5th and 6th grade students to explore questions of income inequality, labor rights, racial justice, and environmental justice. I reflect on ways I observed students' critical consciousness develop over time by engaging with this routine. I end by illustrating how students used this routine to analyze the connection between tap water contamination and poverty, and how they took action by writing letters to government officials about their findings.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. If you use warm-up routines in your classroom: what mathematical and socio-emotional skills do your current routines help students build?

2. In what ways, if any, do these routines build students' critical consciousness and capacity to take action for justice?

3. If you don't currently use warm-up routines: what has prevented you from doing so, and what supports might help you to experiment with them?

4. How do your students currently engage with discussion and debate around real-world issues in your mathematics classes? If they don't currently do so, what have been some of the barriers? What supports might help you to do so?

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Years ago, a fifth-grade student in my mathematics class shared some feedback with me: "Mr. Eric, I like that you include Black Lives Matter protests and social justice topics in your word problems, but when are we going to use math to actually make change?" Shawn's question[1] made me reflect on the inadequacy of the frameworks I was using in my mathematics class. I realized that I had no consistent structures that asked students to use mathematics as a tool to illuminate and dismantle injustices. I considered how to develop a routine that would work toward what Eric Gutstein describes as the three "social justice pedagogical goals" for mathematics teaching. Building on Paulo Freire's frameworks for liberatory literary education, Gutstein asserts that these goals are reading the world with mathematics, writing the world with mathematics, and developing positive social and cultural identities (Gutstein, 2006). I was struck by Gutstein's (2003) description of reading the world with mathematics:

> [To use mathematics to] understand relations of power, resource inequities, and disparate opportunities … dissect and deconstruct media and other forms of representation … examine these various phenomena both in one's immediate life and in the broader social world and to identify relationships and make connections between them. (p. 45)

Inspired by my conversation with Shawn, and by Gutstein's framework, I developed a warm-up routine called "Is it fair that …?" In this routine, I would present students with a data visualization and ask them to answer a question beginning with "Is it fair that …?" For example: "Is it fair that the American government spends our tax money like this?" or "Is it fair that the world map used in most classrooms is the Mercator projection?" Generally, each iteration of this routine took around fifteen to twenty minutes, including time for students to examine the data, write reflections, share with a small group, and discuss as a class. We completed one of these activities every two to three weeks.

I found that this activity was adaptable to meet the needs of a wide range of students, and I successfully implemented versions of this routine in two different school settings: the first over the 2017-2018 academic year and the second over the 2020-2021 and 2021-2022 academic years. At the start of developing this approach, I was teaching a small fifth-grade mathematics class, with fewer than 10 students, at a suburban independent school near Boston. The families in this school were predominantly upper and owning class. These students identified as white, Asian American, and Black. Several students had mild to moderate learning disabilities. I further developed this routine in my sixth-grade inclusion mathematics class in a Boston public school with around 25 students. Since this was an inclusion classroom, several students had IEPs or 504 plans. Around half the class identified as white and around half identified as People of Color, predominantly Latine and Black, and some students were emergent bilinguals. Their families came from highly diverse social class backgrounds and, since this was a pilot school, students commuted from neighborhoods throughout the city.[1]

The kinds of personal experiences students had with the social justice issues addressed in this routine, and their ability to make "text-to-self" connections with the data, varied based on their identities. However, students consistently asserted that the "Is it fair that…?" routine was one of the most engaging activities of our class. In both settings, the routine resulted in some of the liveliest mathematical discussions I've experienced. In this article, I explore my implementation of this routine in both schools.

The next section describes the implementation of this routine in the Boston public school classroom from the 2020-21 and 2021-22 school years, and my description of the water justice project in "Using Data to Take Action" is from my classroom in the suburban independent school during the 2017-2018 school year.

[1] I have changed all student names in this article.

Developing Themes and Facilitating the Routine

To build students' understanding over time, I developed themes to connect the data visualizations we examined over the course of each year. In this article, I'll share two examples of year-long themes: inequity during the Covid-19 pandemic, and environmental justice. In order to develop these activities, I periodically reviewed some of my favorite data sources in search of visualizations addressing topics related to the year's theme (see "Resources for Developing 'Is it fair That …?' Activities," below). In selecting visualizations, I tried to give students experience with a diversity of data representations, including different approaches to graphs, charts, and maps. I also considered the complexity of each visualization to determine what supports would be necessary for all students to fully participate in the analysis and discussion. Depending on the complexity of the visualization, I offered a more scaffolded interpretive process. For example, adapting the Visual Thinking Strategies prompts (e.g., Chaparro, 2022), I sometimes asked a series of questions to deepen students' understanding of the data: "What do you think is going on in this graph? What do you see that makes you say that? What more can we find?" Once I was confident that students understood the visualization, we would move to discussing "Is it fair that…?" questions. For instance, in one routine, students were asked to examine the graph from this *New York Times* article exploring the distribution of COVID-19 vaccinations between rich and poor countries, in order to answer the question: "is it fair that COVID-19 vaccines are being distributed like this?"

Framing this routine around questions of "fairness" invites students to grapple with what they mean when they ask whether something is "fair." I tried to consistently connect these mathematical discussions to conversations we had at other times in our classroom, about what it means to work for equity and liberation, not just equality (e.g., Center for Story Based Strategy, n.d.). I also found that students' divergent understandings of fairness were an important feature of the discussions. As will become clear in the classroom examples below, this framing pushed students to engage with questions such as: "Who is helped and who is harmed by this? In what ways?"

During the 2020-21 school year, while teaching my 6th grade class, we focused on questions of inequity during the Covid-19 pandemic. We examined data that addressed rates of vaccine distribution to different countries, uses of federal funding during the pandemic, and shifts in wealth distribution in the United States. Over time, my hope was to build students' critical analysis connected to inequality during the pandemic.

Early in that school year, we considered the question, "Is it fair that billionaires gained so much money during the pandemic?" Students watched a video - including several graphs - showing that between March 2019 and September 2020, American billionaires had become $637 billion richer (Woods, 2020). After discussing the graphs in small groups, their responses were divergent.

"It is fair, because they already have so much money, so $40 billion would not do much to their bank account," shared Luca.

"And they do deserve it, because people bought from them and they are working hard," agreed George.

Betsy asked their classmates to consider the context: "It depends on how you got your money and what you are using it for. If you are using it for good then it's okay, but if you got your money from things that aren't good and you're wasting it, then it's not fair."

Others had a clear opinion that this was inequitable. Maya said: "Millionaires should give money for Covid testing. Or to help people buy things like groceries."

John agreed. "It is not fair that billionaires gain so much money. They should give more money away than they gain. That is money that could have gone to help people during the pandemic," he asserted. "Now I'm mad." Students often shared their emotional responses to the data we examined, and several remarked that they were not used to feeling emotional investment in what we studied in mathematics class. Their emotional engagement also led them to look closer at the data – and to ask questions about actions we could take in response to what we were learning.

My personal response to the questions I posed to students was often, "No, this isn't fair." But I tried as much as possible to let the students offer feedback to each other, instead of trying to control the discussion — as long as

nothing students shared was hurtful. I did offer guiding questions during some discussions in response to students' observations. For example, I later asked George, who thought it was fair for billionaires to make that much money because they are working hard, "do you think the billionaires are working harder than the people who work for them?" I asked Betsy, "do you think it's better for rich people to 'do good' with their money, or for the government to provide services for people?"

I often reminded students that there was no one "correct" answer to the questions we explored in this routine. I myself didn't always have answers to students' questions. I would often either encourage students to do their own research and get back to us about what they found out, or I would offer to investigate an unanswered question myself, and then give them an update. If discussions became heated, I found it helpful to refer all of us back to our collectively created classroom agreement (for further reflections on classroom agreements, see Fishman, 2021).

In June 2021, as an extension to the "Is it fair That …?" routine, students completed a multi-day project exploring the gap between salaries of CEOs and the lowest paid workers in their companies. This project asked students to utilize a range of mathematical skills learned throughout the year, including division with decimals, as well as simplifying and reasoning with fractions and ratios (see, e.g., the handout I developed for this activity, which utilizes data from the U.S. Securities and Exchange Commission, n.d.) You could also make this project slightly easier by compiling a list of options of CEO salaries and corresponding worker salaries for students to use, instead of having them look up the salary information themselves (see, e.g., Equilar, 2024).

Although there was some disagreement between students about the "fairness" of the salary gap during this final project, I noticed a significant shift in students' reasoning over the course of the year. Some students who had previously been in favor of billionaires making more money had changed their thinking. George, for example, now asserted, "No it's not fair, because the CEO of Nike gets paid $26,750 per hour and the workers make $20 an hour or less."

Others demonstrated a more robust critical and mathematical analysis than earlier in the year. Elliot, for example, argued that "The CEO barely does anything besides make choices! Workers are tired from working 40 hours or more a week."

"It's not fair because Elon Musk isn't working as hard, but he gets over 80,000 times the pay as his workers in Tesla," agreed Meyer.

Maya made a connection to her learning about labor strikes during the pandemic. "Amazon people went on strike." George asked why, and Maya explained. "They weren't getting paid enough, even though they were working twice as hard as the CEO." Even though each "Is it fair that …?" activity is short, students can build insight over the course of the year through practice with this routine.

During the 2021-2022 school year, many of the "Is it fair that …?" conversations connected to units from students' ELA, social studies, and science classes about environmental justice, and particularly climate justice (for an example of this theme-based climate justice curriculum, see Fishman, 2023). For example, we examined data related to the distribution of green space in Boston, Black farmers' loss of land in the United States, and the question of international climate change reparations. This was another approach to help deepen student responses, despite the routine's relative brevity: building on background knowledge students were acquiring in other subjects. For students who might otherwise struggle to think critically about the data, these connections were helpful. For example, when examining a visualization depicting the connections between countries' relative wealth and their CO_2 emissions, I could ask students: "Does this data remind you of anything we read about the idea of 'climate justice' in *How to Change Everything* (Klein, 2021) last week?" Drawing these thematic connections also helped students see their mathematical learning as more integrated with the reading, writing, and thinking they were doing in other subject areas.

Using Data to Take Action

For Gutstein, "writing the world with mathematics" is "a developmental process, of beginning to see oneself capable of making change … developing a *sense of social agency* … a belief that [one is] capable of contributing to historical processes" (Gutstein, 2006, p. 27). My student Shawn's original question demonstrated just such a desire for social agency: "When are we going to use math to actually make change?" This question stuck with me, and I often considered how I could expand this routine to help students use what they'd learned to take action.

I've found that there is space for this routine to evolve into longer youth action projects, such as an environmental justice investigation that asked: "Do different communities in the Boston area have fair access to clean water?" We began with a discussion of the history of governmental neglect of clean water access in working class communities and communities of color. Students then used the Environmental Working Group Tap Water Database (2021) to study whether there was a correlation between poverty levels and the level of contaminants in public water supplies in the Greater Boston area. Each student chose two cities or towns to analyze; students combined their data to develop visualizations and draw inferences. Students researched possible solutions, then wrote letters to stakeholders, including state senators, the Massachusetts governor, and the director of water supply protection for the state. Although not all students received responses, a handful did later receive replies from the stakeholders, thanking the students for the perspectives they shared and outlining steps they were taking to work toward tap water purity.

In their letters, students explained the main conclusions they wanted people to take away from their research. Edgar, for example, explained:

> We found that as poverty level increases the concentration of contaminants over the health guideline increases. For example, if you live in North Amherst, the concentration of the contaminants in the water is 7,000 to 8,000% higher than what's healthy. Many of these contaminants such as bromodichloromethane, chloroform and many more can cause cancer. People are suffering from their contaminated water.

Yasir gave a powerful argument for why the Massachusetts Department of Public Health should take action:

> We think you should take action because, word for word, your website says, "the Department focuses on preventing disease and promoting wellness and health equity for all people." Your mission is to help people have health equity. This data shows that people do not have health equity with water. Here are some suggestions: fund programs that improve tap water quality, replace old, corroded pipes, upgrade treatment and distribution facilities and strengthen and enforce existing standards.

Later that week, I watched Shawn look determined as he put his letter into the mailbox. He turned to me and smiled. He was using math to make change.

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Resources for Developing "Is It Fair That …?" Activities

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Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. In what ways could "Is it fair that …?" build on mathematical routines or discussion structures already present in your classroom?

2. What structures, practices, and classroom agreements would support your students to effectively engage in hard conversations brought up by this routine?

3. What social justice theme(s) would be engaging for your students to investigate using this routine in math class this year? Try having a conversation with your students to explore what topics are on their minds. Or ask other teachers on your grade team to find out what social justice theme(s) students are learning about in their other classes.

4. Try this: using the resources above, find 2-3 data visualizations as a starting point to implement a version of "Is it fair that …?" in your classroom.