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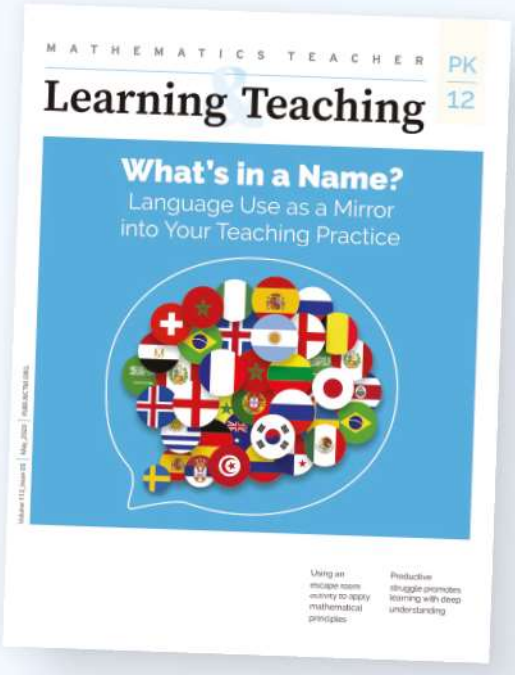

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Young Mathematicians Take Action Through Sport Clinics

A community-based mathematical modeling task focuses on exploring issues of inequities and lack of access to youth sports.

Jennifer Suh, Gretchen Maxwell, Kate Roscioli, Holly Tate, Padmanabhan Seshaiyer, and Risto Marttinen

A powerful way to build students' mathematical power and agency is through Teaching Mathematics for Social Justice (TMfSJ), where students read and write the world with mathematics (Gutstein, 2005). Reading the world with mathematics uses mathematics to understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, class, gender, language, and other differences, while writing the world with mathematics involves taking action (Gutstein & Peterson, 2013). This sense of criticality (Muhammad, 2023) allows students space to "name and critique injustice to help them ultimately develop the agency to build a better world" (p. 12). TMfSJ requires teachers to be reflective, sensitive, and knowledgeable about the complexity of the social justice issue at hand (Felton-Koestler, 2020). To support teachers in TMfSJ, many recent resources have been developed with

exemplar lessons (Anhalt et al., 2018; Bartell et al., 2022; Berry et al., 2020; Harper, 2019; Koestler et al., 2022; Matthews et al., 2022). Bartell et al. stated, "When teachers can draw from the lives and interests of students, families and communities meaningful instruction happens" (2022, p. 1) and can provide context that is familiar, personal, and connected to students in the classroom. Many pressing social justice issues exist, including racial justice, economic inequities, fair access to opportunities (social, educational, political, economic, etc.), participation, and human rights. Sport is an influential and familiar entry space to examine issues of access, diversity, inclusion, and unity. In this article, we share one teacher's story of how she used her students' interests to uncover reasons for the economic inequalities and fair access to sports at their local high school.

Mrs. M. teaches sixth-grade mathematics and lives in the school community. She was inspired to create this mathematical modeling lesson based on her personal lived experience and what she observed about inequities in sports participation at the local high school. She noticed that several sports that students played in high school were not ones that children were able to experience in the years leading up to high school (in particular softball, which her daughter played). She recognized this as an inequity to youth participation in sports and realized that access to many sports is a privilege because of the costs to participate, purchase equipment, and travel to practices and games. While some sports—such as soccer and basketball—are easier for a child to pick up because of lower costs and multiple accessible fields and courts in some neighborhoods, others are more restricted by cost and access, such as swimming, volleyball, tennis, and lacrosse. This opportunity gap can prevent students from participating in team sports in high school, which is an opportunity associated with improved social and psychological health (Andersen et al., 2019) and collegiate scholarships (Pandya, 2021). The value of being on a sports team is not just about staying active; it also provides daily opportunities to practice collaboration, time management, self-esteem building, leadership, pressure and stress management, and sportsmanship.

One of the most authentic ways to plan for a powerful lesson is to center it around a community issue in

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which the teacher has the socio-political consciousness (Ladson-Billings, 2014) to point students to uncover inequities and take action. Mathematical modeling involves posing mathematical problems in authentic real-life contexts that are relatable to students' interests, knowledge, and skills and that enable students to use mathematics to help make decisions, predict, and determine meaningful solutions to the problem (Aguirre et al., 2019; Carlson et al., 2016; Consortium for Mathematics and Its Applications [COMAP] & Society for Industrial and Applied Mathematics [SIAM], 2016; Turner et al., 2021). Community-based mathematical modeling (CBMM; Suh et al., 2023) that is focused on issues of social justice begins with students making sense of specific problems situated within their local community, then using mathematics and their models to take action (see Figure 1).

Planning and Enacting a Justice-oriented, Community-based Mathematical Modeling Task

Mrs. M. worked with mathematics educators, a sports educator, and other teachers in her school to plan this task. While designing the task, we attended to five design principles with planning prompts (see Figure 2) for CBMM (Suh et al., 2023). In the next section, we will share how the design prompts helped guide our decisions and how we enacted the task to attend to the dual focus of social justice and mathematics, while we engaged in building awareness and taking action to alleviate a community issue.

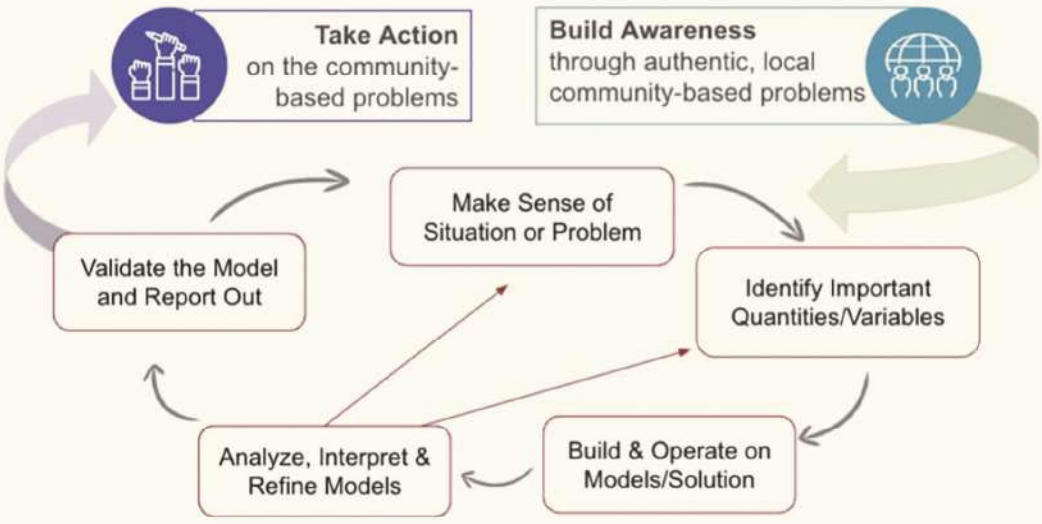
Design Prompt 1: How do You Build Meaningful Connections and Context Focused on Social Justice Issues?

First, Mrs. M. wanted to connect the CBMM task to students' lived experience and their community. We considered Design Principle #1: CBMM is situated in local community issues that can be connected to global issues. Though many sports are popular in schools, there is a concerning shift reported by the Aspen Institute (2015) from school-based sports participation to private, club sports that use a pay-to-play model. The report shares socio-demographic data that illustrates the racial and economic disparity. More specifically, parents spent $30-40 billion on their children's sports activities: a proportion that differs by race, as White families spent more on sports for their children than did Black families. To further explore the issues of access to sports, Mrs. M. asked her students to read a related article from *ESPN News* (Cohen, 2019). Students then reflected on the article with a notice and wonder chart (see Figure 3).

Design Prompt 2: How Can Mathematics be Used to Unearth Factors Related to Social Justice Issues?

In this lesson, we wanted to attend to Design Principle #2: CBMM prioritizes connecting mathematics to social

Figure 1 Community-based Mathematical Modeling Cycle



Note. From Suh et al., 2023.

issues. Data related to the situation help students use mathematics to better understand the phenomenon or social issues. Students explored data from the Aspen Institute (link online), which surveys youth nationally to understand perspectives on youth sports and advocates for removing barriers to participation, such as high costs, lack of transportation, and limited availability in underserved communities. We showed data from the most recent report on how income impacts sports participation (see Figure 4), and students quickly

Figure 2 Design Principles and Prompts for Planning Justice-Oriented Community-based Mathematical Modeling

Design Principle #1: *CBMM tasks are situated in authentic local community issues.* Together the teacher and students pose a mathematical modeling question that impacts the local community	**How do you build meaningful connections and context focused on social justice issues?**
Design Principle #2: *CBMM tasks explore data to identify and understand social issues.* Data related to the situation help students use mathematics to better understand the phenomenon or social issues.	**How can mathematics be used to unearth factors related to social justice issues?**
Design Principles #3: *CBMM tasks use rigorous mathematics to describe, predict, optimize, and make decisions about a situation centering issues of social justice.*	**How do you sustain the rigor of the mathematics as you explore issues of social justice?**
Design Principles #4: *CBMM tasks encourage the co-construction of ideas through collaboration, negotiation, and justification to build collective knowledge through community.*	**How do you attend to important mathematics processes and practices as students engage and make meaning of the issue?**
Design Principles #5: *CBMM tasks yield useful and solution-oriented action for community stakeholders.* Students feel empowered by bringing awareness and taking actions and attaching the learning experience with civic empathy.	**How do you move beyond awareness to taking action on social justice issues?**

Note. From Suh et al., 2023.

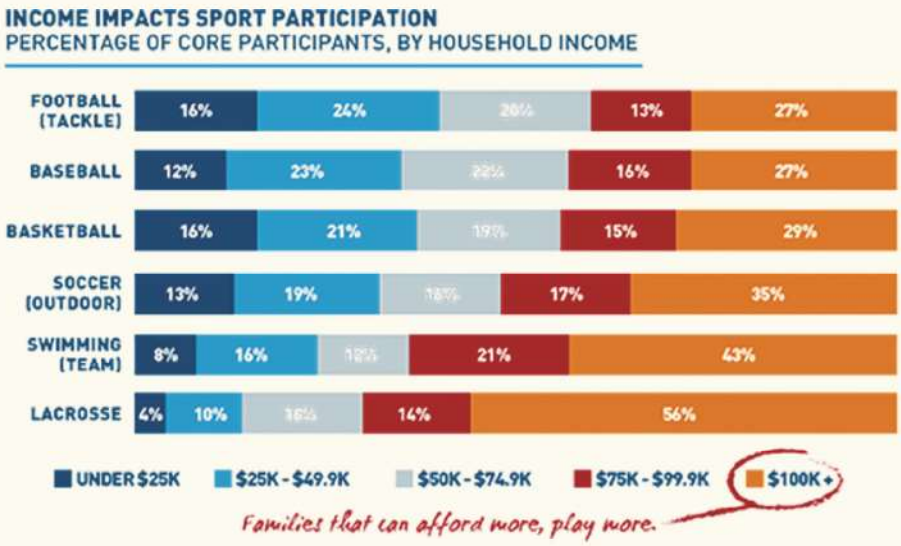
Figure 3 Notice and Wonder from Reading the Article About Youth Sports Participation

I noticed…	I wondered…
• Many families do not make enough money to allow their children to play sports. • Because of the pandemic, there is a decrease in sports participation • Some children are not playing sports because of the cost, inconvenience, or not being interested in a sport. • Some children cannot play the sports they love due to cost and the location.	• Why does playing sports cost so much? • If playing sports is healthy, why not offer them free? • Is there a way to keep the cost down? • Why does it cost so much to play travel and club leagues? • When will the leagues lower their fees? • How can we keep children entertained and interested in sports?

noticed that children from low-income families—particularly amongst communities of color—are half as likely to play sports as children from homes with higher incomes. The inequity that families who can "afford more, play more" became clear (see Figure 4). In addition to cost, students discussed the inconvenience of travel sports, where players were dependent on transportation from others and accommodations at far-off competitions. Some students shared background knowledge regarding sports that require playing-field fees (such as tennis, hockey, and swimming), coaches' fees, and equipment fees.

In another way to deepen their understanding concerning inequality of access to sports, Mrs. M. showed students maps of two different school communities and their sports facilities (see Figure 5). Maps are another

Figure 4 Data Talk Around Participation Disparities Based on Household Income (Aspen Institute)



Note. From The Aspen Institute, 2015.

Figure 5 Using Spatial Representation Data to Analyze Issues of Inequities by Local Facilities

way students can unpack issues of social justice, more specifically, access to fields and sports facilities in different communities (Rubel et al. 2016). She asked students to share their noticing and wonderings. Students noticed that the map on the right in Figure 5 was their school community, and it featured red spots that represented sports facilities and fields that were not within walking distance. The other community had more green space and sports facilities less than a mile away. One student said, "I see major highways on our map so it would be too dangerous even if we wanted to walk to the fields." This visualization helped them understand how transportation and access to green space are some underlying, systemic issues related to this problem. In fact, they discussed how some wealthier communities have amenities like golf courses, pools, and multiple parks that are well-maintained, but that are not accessible for people in lower-income areas.

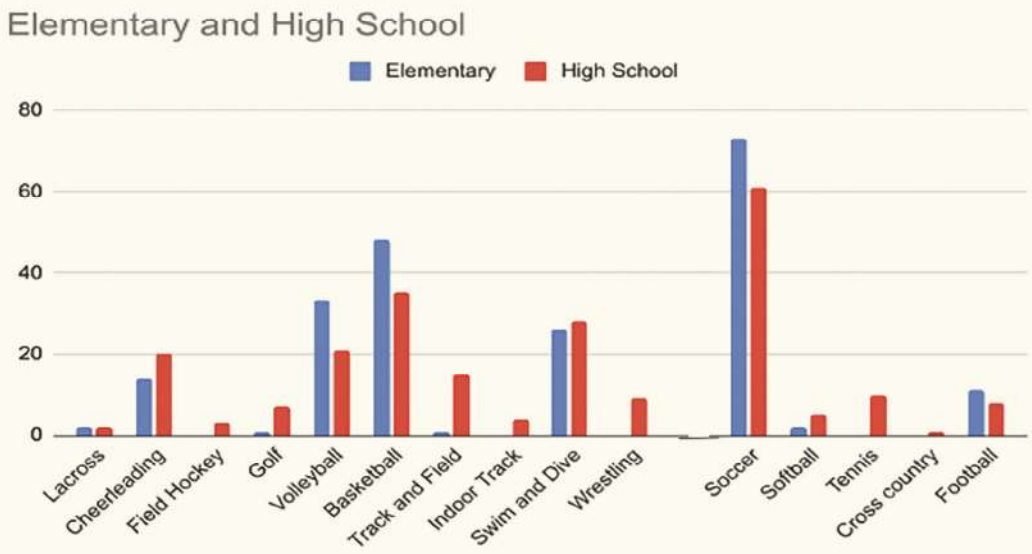
Design Prompt 3: How do You Sustain the Rigor of the Mathematics as You Explore Issues of Social Justice?

As a planning team, we considered Design Principles #3: CBMM tasks use mathematics to describe, predict, optimize, and make decisions. We asked ourselves, "What mathematical modeling task can be designed around this issue where mathematics helps make important decisions?" and "What are relevant mathematics skills that students can use to make sense of the phenomenon?"

Students were inspired by the *ESPN News* article to offer a sports clinic at their school to introduce students to sports they were not familiar with. To identify the sports they wanted to offer, students created a poll and disseminated it to students in grades 3 through 6. The class devised the two overarching questions for the poll: "What sports do you play right now?" and "What sports do you want to play in high school?" They also asked them what they thought the barrier was to playing sports. Students felt that displaying and interpreting this data would help them make better decisions about what sports they wanted to offer in the after-school sports clinic. Using Google Sheets, they learned that they could take the data and display the information in different charts, and that they had to think about what graph made the most sense to represent their data, which built on their data literacy skills (6.SP.5, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) when applied to reading charts and graphs (Figure 6).

After students created their graphs, they had a class discussion to determine how to use this data to select sports for the after-school sports clinic.

Figure 6 Example of Student-generated Graph Based on Data Collected from Survey



Teacher: *How can we use our data to determine which sports we should offer?*

Jemma: *We should pick the sports that had the highest votes, like basketball and soccer, and the lowest votes (field hockey and tennis or gymnastics), because we can have some sports students are familiar with and new sports that they never have tried.*

Trey: *Well, I think we should pick the lowest votes and others, because if they are popular, then they already have access to those sports.*

Raymond: *We really should just pick four sports, so that we can have good enough time to rotate and have people try different sports when they come for the clinic.*

Another important discussion centered on the student graphs depicting barriers to sports (see Figure 7). Much like the article, the cost of joining teams and purchasing equipment rated high in their poll. However, an interesting outcome in their poll was how students rated time commitment and schedule as the biggest barrier to joining a sport. In discussing the results of the survey, one student shared, "I cannot participate in team sports because I am the oldest and I have six younger siblings that I have to take care of after school." Others shared other family responsibilities and weekend activities. They noticed that the survey data showed that lack of participation was not due to students not being interested in team sports, but instead to the conflicts in their schedule, the cost of joining the sport, and the costs of equipment and transportation.

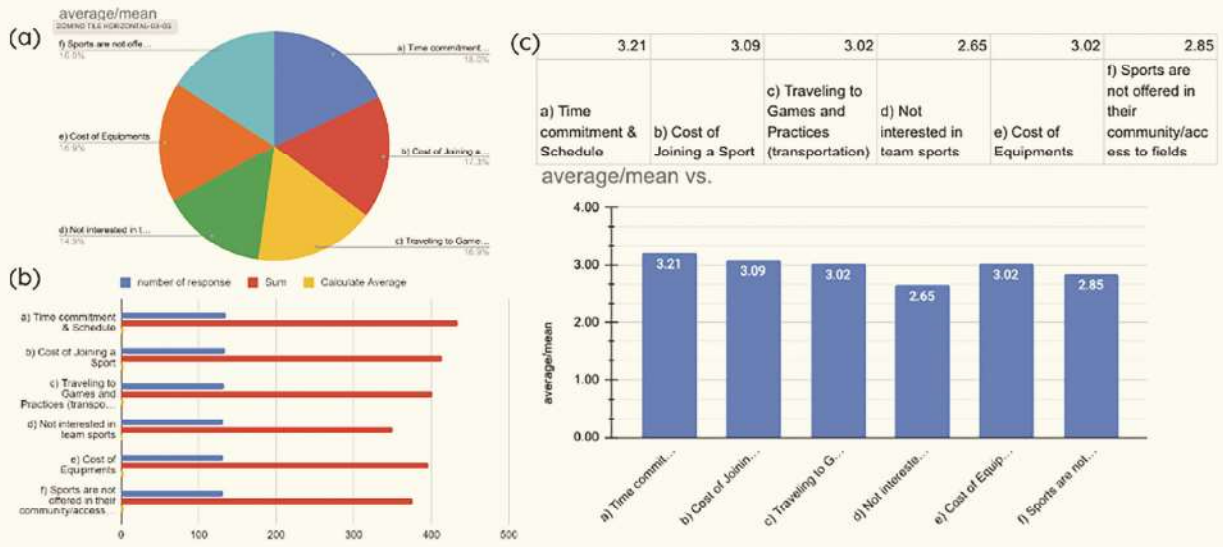
As students presented their graphs, Mrs. M. asked purposeful questions to make mathematics visible. Group A presented their pie chart (Figure 7a), which represented the different barriers, with percentages displayed. Students listening to the presentation offered compliments as well as feedback. One student said, "I like the colorful display. It is a bit hard to see the difference using a pie chart. I would have to read closer to the percent to see the difference." Group B presented their bar graph (Figure 7b), which graphed the number of responses, sum, and mean/average. The students shared how it was clear to see what the greatest barrier was with the red bar, which was the weighted sum on the Likert scale. Mrs. M. questioned the students to see how they felt the data communicated the information they wanted to share.

Mrs. M.: *What does the yellow represent?*

Group B: *The average, which is the mean.*

Mrs. M.: *Why might it be so hard to see the mean data? Do you think you need to graph the number of responses? How are the sum and the mean related?*

Figure 7 Student-Created Graphs Based on Survey Results Related to Barriers to Participating in Sports



Group B: *It might be easier to see the data if we displayed just the mean or just the sum, because the number of the sum is so high compared to the mean which is single digits.*

Here, Mrs. M. wanted to make sense of the data that they had in their Google Sheet. The ease of inserting a chart in Google Sheets allowed students to experiment and quickly make different graphs. The goal of this data-talk was for students to discover how to consider scale intervals; how to select the amount and type of data to display on one graph; and how the sum, number of response, and mean are related. Group C used the data from the survey to take the sum and divide by the number of responses to display a bar graph of the mean (Figure 7c).

This rigorous task enabled students to shape the different elements of the data cycle as they developed and administered a survey, processed the data, and chose the most appropriate representation to visualize the data. As a class, they communicated their graphical representations and offered feedback about the appropriateness of each visualization. This discussion led them to think about how they might make an informed decision.

Design Prompt 4: How do You Attend to Important Mathematics Processes and Practices as Students Engage and Make Meaning of the Issue?

As groups worked together, there were lively discussions and debates that aligned to Design Principles #4: CBMM encourages co-construction of ideas through collaboration, negotiation, and justification through a group-worthy task (Cohen & Lotan, 2014). Mrs. M. introduced a decision matrix to help students make decisions about selecting sports. Decision-matrix techniques are used to define, weigh, and appropriately sum the attributes to give a relative ranking among choices. Mrs. M. asked each group to use the decision matrix, devise a plan for the sports clinic based on their analysis of the data, and present their plan to the class. The class brainstormed the criteria that would be important to consider and arrived at four criteria (see Figure 8) to rank.

One group argued that we needed to expose children to sports that they might not have ever tried, like dancing, cheering, gymnastics, and tennis. They reasoned that this clinic's goal should be to offer an opportunity that children might not be able to have otherwise. Space and coach availability seemed more important to the students than popularity of sport. During the second phase, Mrs. M. revealed the names of some coaches already committed to help and the sports they could coach, and she encouraged groups to revise their matrices based on this new knowledge. A student in one group shared, "We made volleyball higher [priority], because now we realize we have a good coach for that."

Design Prompt 5: How do You Move Beyond Awareness to Taking Action on Social Justice Issues?

Once the students completed their decision matrix process and chose their sports, they worked on logistics.

Figure 8 Class Decision Matrix and Planning

Sports	Points from **survey data**	Fun factor	Access at our school	Coaches	Total
Soccer	5	4	5	5	19
Basketball	4	4	5	5	18
Volleyball	4	4	5	5	18
Dance/ Cheer/ gymnastics	3	3	5	5	16
Tennis	3	3	5	5	16
Track	4	3	4	4	15

This work opened other opportunities for mathematical modeling, as students extended their task to actually plan the event. The event served as a pilot to test out whether an after-school sports clinic would be a viable structure to bring more access to affordable youth sports in the community. Students considered space for different sports and used measurement and area to lay out the station locations on the school grounds. They also discussed budgeting computations for any necessary equipment or snacks. Students also had to use their skills around elapsed time when planning for an optimal rotation schedule to expose participants to as many sports as possible. With a plan in place, the sixth graders hosted an after-school sports clinic, with four volunteer student-athletes from local universities serving as coaches (see Figure 9).

After the pilot sports clinic, the class interviewed a sports education professor and learned more about how to increase access to youth sports. He explained that the lack of adequate transportation is one of the biggest issues and described how a focus on offering sports closer to the community—the schools, YMCAs, and churches—on weekends eliminates many of the barriers of transportation and scheduling challenges. He also suggested ways to advocate by writing a letter to the students' School Board representative. Figure 10 shows a letter from one of Mrs. M's students that she wrote to the schools' superintendent.

Taking action can come in many forms, such as hosting the actual event or talking with the school community about the inequities and advocating and mobilizing community members and organizations around a cause. This approach aligned with Design Principles #5: CBMM yields useful and solution-oriented action for community stakeholders. Writing this letter to the superintendent was an effort for the students to take part in bringing about a more sustainable change to the system. Advocating through their voice and mathematics empowers students to see how they can use mathematics to make a compelling argument to make structural changes within their schools that could bring about a change to provide more access to team sports to prepare younger students to practice and learn the skills needed to try out for high school sports.

Reflection and Future Direction

Mrs. M. and her students felt connected to this task because of its relevance to their community reality. Choosing an issue that was close to home allowed the teacher to take a real-world issue and bring awareness

Figure 9 After-School Sports Clinic in Action

and motivate the students to take action to create a solution. As we reflect on how we co-designed this task and empowered students to take action when faced by inequities, we were reminded of the four important reasons that Berry et al. (2020) gave for teaching mathematics for social justice, as it

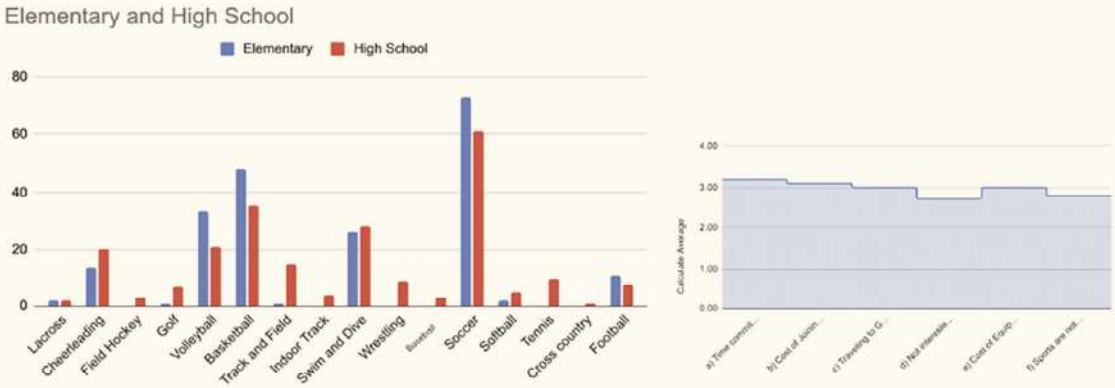
- builds an informed society;
- connects mathematics with students' cultural and community histories;
- empowers students to confront and solve real world challenges they face; and
- helps students learn to use mathematics as a tool for social change (p. 2).

We shared the design principles and prompts along with this lesson story so they can inspire you and your colleagues to plan community-based mathematical modeling tasks around an issue that may be part of your story or one that is close to your home. We have found that engaging in CBMM, situated in issues in their local community, motivated our young mathematicians and empowered them to use mathematics to make decisions and take action.

Figure 10 Letter to School Board Representative to Raise Awareness and Take Action

Dear Mr. Superintendent of Schools,

My class and I would like to create a Sports Clinic for kids who don't have the money and transportation to join sports teams. We would like to do this sports clinic to help expose children to brand new sports. Based on data, we collected some sports kids want to play in high school but currently aren't like dance/cheer/gymnastics, tennis, and volleyball. And to get students to come we could offer a favored option, soccer.



After we found sports they would like to play, we found some important barriers to joining a sport that kids face. Those barriers are things like cost of joining a team, cost of equipment, packed schedules. I believe sports are incredibly important for children our age (my school) because I have six siblings and I cannot participate. Sports are a great way to make new friends and bond. I ask you if the school board would please consider funding an 8-week fall (and if it goes well, maybe again in the spring) Sports Clinic program. Some fellow students in my class and I helped run a test drive in SACC (after school care center) to see our sports clinic in action and the kids had a great time. They had fun trying new sports and I feel other kids would like to try out some new sports. But to do this for our school, we need the school board to please help fund our sports clinic. We will need to pay for equipment, coaches etc. We (my class and I) worked with some of our teachers to pull this off and turned this idea into a reality.

Elena from Mrs. M's 6th Grade Math Class

REFERENCES

Andersen, M. H., Ottesen, L., & Thing, L. F. (2019). The social and psychological health outcomes of team sport participation in adults: An integrative review of research. *Scandinavian Journal of Public Health, 47*(8), 832–850. https://doi.org/10.1177/1403494818791405

Anhalt, C., Staats, S., Cortez, R., & Civil, M. (2018). Mathematical modeling and culturally relevant pedagogy. In Y. J. Dori, Z. Mevarech, & D. Baker (Eds.), *Cognition, metacognition, and culture in STEM education* (pp. 307–330). Springer. https://doi.org/10.1007/978-3-319-66659-4_14

Aguirre, J. M., Anhalt, C. O., Cortez, R., Turner, E. E., & Simic-Muller, K. (2019). Engaging teachers in the powerful combination of mathematical modeling and social justice: The flint water task. *Mathematics Teacher Educator, 7*(2), 7–26. https://doi.org/10.5951/mathteaceduc.7.2.0007

Aspen Institute (2015). *Sport for all: Play for life*. https://www.aspeninstitute.org/wp-content/uploads/2015/01/Aspen-Institute-Project-Play-Report.pdf

Bartell, T. G., Yeh, C., Felton-Koestler, M., & Berry, R. Q. (2022). *Upper elementary mathematics lessons to explore, understand, and respond to social injustice*. Corwin Press.

Berry III, R. Q., Conway IV, B. M., Lawler, B. R., & Staley, J. W. (2020). *High school mathematics lessons to explore, understand, and respond to social injustice*. Corwin Press.

Carlson, M. A., Wickstrom, M. H., Burroughs, B., & Fulton, E. (2016). A case for mathematical modeling in the elementary school classroom. In C. R. Hirsch & A. R. McDuffie (Eds.), *Annual perspectives in mathematics education (APME) 2016: Mathematical modeling and modeling mathematics* (pp. 121–129). National Council of Teachers of Mathematics.

Consortium for Mathematics and Its Applications & Society for Industrial and Applied Mathematics. (2016). *GAIMME: Guidelines for assessment & instruction in mathematical modeling education*.

Cohen, K. (2019, Aug. 19). Kids aren't playing enough sports. The culprit? Cost. *ESPN News*. https://www.espn.com/espn/story/_/id/27356477/children-playing-enough-sports-culprit-cost?platform=amp

Cohen, E. G., & Lotan, R. A. (2014). *Designing groupwork: Strategies for the heterogeneous classroom* (3rd ed.). Teachers College Press.

Felton-Koestler, M. D. (2020). Teaching socio-political issues in mathematics teacher preparation: What do mathematics teacher educators need to know? *The Mathematics Enthusiast, 17*(2,3), 435–468. https://doi.org/10.54870/1551-3440.1494

Gutstein, E. (2005). *Reading and writing the world with mathematics: Toward a pedagogy for social justice*. Routledge. https://doi.org/10.4324/9780203112946

Gutstein, E., & Peterson, B. (Eds.). (2013). *Rethinking mathematics: Teaching social justice by the numbers*. Rethinking Schools.

Harper, F. K. (2019). A qualitative metasynthesis of teaching mathematics for social justice in action: Pitfalls and promises of practice. *Journal for Research in Mathematics Education, 50*(3), 268–310. https://doi.org/10.5951/jresematheduc.50.3.0268

Koestler, C., Ward, J., Zavala, M., & Bartell, T. (2022). *Early childhood mathematics lessons to explore, understand, and respond to social injustice*. Corwin.

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: A.k.a. the remix. *Harvard Educational Review, 84*(1), 74–84.

Matthews, L. E., Jones, S. M., & Parker, Y. A. (2022). *Engaging in culturally relevant math tasks fostering hope in the elementary classroom*. Corwin Press.

Muhammad, G. (2023). *Unearthing joy: A guide to culturally and historically responsive curriculum and instruction*. Scholastic.

National Council of Teachers of Mathematics. (2020). *Catalyzing change in early childhood and elementary mathematics: Initiating critical conversations*.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common core state standards for mathematics*. http://www.corestandards.org

Pandya, N. K. (2021). Disparities in youth sports and barriers to participation. *Current Reviews in Musculoskeletal Medicine, 14*(6), 441–446. https://doi.org/10.1007/s12178-021-09716-5

Rubel, L. H., Hall-Wieckert, M., & Lim, V. Y. (2016). Teaching mathematics for spatial justice: Beyond a victory narrative. *Harvard Educational Review, 86*(4), 556–579, 616-617.

Suh, J. M., Tate, H., Rossbach, M., Green, S., Matson, K., Aguirre, J., Seshaiyer, P., & Steen, S. (2023). Dilemmas and design principles in planning for justice-oriented community-based mathematical modeling lessons. *Mathematics Teacher Educator, 11*(3), 210–230. https://doi.org/10.5951/MTE.2022-0025

Turner, E., Roth McDuffie, A., Aguirre, J., Foote, M. Q., Chapelle, C., Bennett, A., Granillo, M. & Ponnuru, N. (2021). Upcycling plastic bags to make jump ropes: Elementary students leverage experiences and funds of knowledge as they engage in a relevant, community-oriented mathematical modeling task. In J. Suh, M. Wickstrom, & L. English (Eds.), *Exploring mathematical modeling with young learners* (pp. 235–266). Springer. https://doi.org/10.1007/978-3-030-63900-6_11

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