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Integrating Social Justice into Mathematics Curriculum

Marcia Lynn White

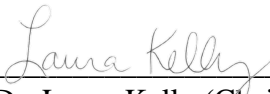
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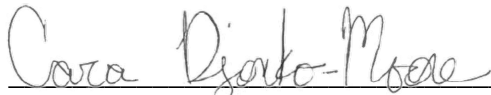
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## Abstract

### Integrating Social Justice into Mathematics Curriculum

Marica Lynn White

Mathematical literacy has long been a gatekeeper to higher learning opportunities. Mathematics teaching and learning, mainly through the lens of social justice pedagogy, can motivate students from diverse backgrounds to recognize the power of mathematics as an analytical tool to accomplish their personal goals, such as using mathematics to lead to social, political, and economic empowerment. Mathematics is political in that it can preserve systems of privilege and oppression and be used as a tool to investigate and dismantle such structures. Learning mathematics through a social justice framework is essential for students in that it allows learning math concepts while also providing opportunities to become agents of change. This curriculum project will enable students to analyze real-world data about the United States hourly wage compared to a family's cost of housing per month, specifically for the city of Memphis. The five-lesson unit's ultimate goal is to develop students' critical thinking and problem-solving skills as well as socio-political consciousness to present an argument, either in favor of an increase to the minimum wage or not.

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## Overview

The dilemma of how to teach effectively from a clear social justice perspective that empowers students to think critically while promoting social change has been a consistent challenge for educators. Although some researchers suggest increasing interest in integrating mathematics and social justice issues, there remains a misunderstanding about efforts to combine these two particular subject areas.

The mathematics education research community has incorporated more sociocultural perspectives into its ways of understanding and examining teaching and learning, which has fractured this community. Some view mathematics as apolitical and neutral, and further believe math education should be confined to algorithms, postulates, and theorems—after all, what does power have to do with a rational, universal field like mathematics? On the other hand, others like Rochelle Gutiérrez, professor of math education, and LatinX students recognize the benefits we have gained from including sociocultural perspectives. She cautions educators that not attending to identity and power means we are, at best, fooling ourselves about prospects and, at worst, likely to ensure that mathematics education will be unable to realize its full potential for the twenty-first century (Gutiérrez, 2013).

It is a critical time in our world and our nation, and indeed our educational system mirrors much of what goes on in society. COVID-19 has impacted every individual on this planet and forced us to reconsider and reimagine what it means to be normal. In the wake of the Black Lives Matter Movement and global protests against police brutality and racial injustice, I assert it is impossible and irresponsible for educators to ignore the impact that such disturbing events have had and will have on our students. Marinda Harrell-Levy, an assistant professor of human development and family studies at Pennsylvania State University, and her collaborators (2016) said the time is now to revisit the role of teachers and schools: “There’s a lot of emotion surging through a lot of

[youth] right now, who don't have any experience on what to do with it, and how to deal with it" (p. 100). They further argue "There's a mental toll to . . . literally seeing life leave bodies on YouTube, again and again. We've got to give them the tools . . . to process in ways that are healthy and will actually build our democracy" (p. 100). Consequently, issues of social justice and equity should become actively discussed and explored in our classrooms.

Within the last decade, there has been an increase in the number of authors and educators exploring the concept of Social Justice Education (SJE). Teaching for social justice is defined differently in various social contexts. It has been given numerous labels, such as social justice pedagogy, cultural pedagogy, social reconstructionist teacher education, anti-oppressive education, and is sometimes synonymous with multicultural education. The lack of clarity has resulted in educators claiming to teach from this perspective but seriously missing the mark. My thesis will lead the reader through the research and literature review of teaching mathematics for social justice (TMSJ) as well as compare and contrast the varied meanings and theoretical frameworks of SJE. Based on the inquiry, I will construct a working definition of SJE and why teachers should consider this approach, particularly in secondary math classrooms. Then, I will explore the challenges and successes of this blended curriculum through various case studies. Lastly, the Appendices includes a five-lesson curriculum unit on solving and graphing linear equations that have transformed a traditional lesson into a social justice unit of study.

### **Navigating the Meaning of Social Justice Education**

Multiple understandings of SJE exist; however, what it "actually means is struggled over, in the same way, that concepts such as democracy are subject to different senses by different groups with sometimes radically different ideological and educational agendas" (Apple, 1995, p. 335). A literature review reveals a wide range of definitions,

and with a variety of meanings comes a diversity of understandings resulting in contradictory efforts under the SJE heading. Those unfamiliar with it might see SJE merely treating all students equally. In contrast, others might think it involves the dismantling and rebuilding of education from its very core. Having a wide range of definitions and various views ultimately does the field a disservice by diluting its essence and weakening the call to be agents for change.

As aforementioned, SJE has been given numerous labels, ranging from social justice pedagogy to critical pedagogy to culturally responsive teaching. What further complicates framing a consistent definition of SJE is its comparison and the stark similarities to “multicultural education.” James Banks mostly recognized as “The Father of Multicultural Education” is highly regarded for his pioneering scholarship in the field of multicultural education (Brown, 2018). His research and writings paved the way for culturally relevant pedagogies and SJE and greatly influenced education theorists such as Lisa Delpit, Gloria Ladson- Billings, and Geneva Gay. Banks and Banks (1997) defines multicultural education as

An idea, an educational reform movement, and a process whose primary goal is to change the structure of educational institutions so that male and female students, exceptional students, and students who are members of diverse racial, ethnic, language, and cultural groups will have an equal chance to achieve academically in school. (Banks & Banks, 1997, p. 203)

Multicultural education dictates that educators seek to infuse content and curriculum from diverse cultural groups to enable students to be, in Banks’s terms, “critical consumers’ capable of challenging oppressive ideologies and striving for a more just society” (Casey, 2010, p. 5).

Banks offers five dimensions of multicultural education (Banks, 1995). They are (a) content integration, (b) the knowledge construction process, (c) prejudice reduction,

(d) an equity pedagogy, and (e) an empowering school culture and social structure. All support and serve as a foundation of SJE. Content integration describes the ways in which teachers incorporate content from a variety of cultures to illustrate key concepts in their subject area. The knowledge construction process consists of the approaches and questions teachers use to help students examine and determine how cultural assumptions and prejudices within a discipline may influence knowledge construction. The prejudice reduction dimension relates to the characteristics of students' racial attitudes or perspectives. Teachers must lead students to develop a more democratic and wide-ranging outlook. An equity pedagogy challenges teachers to examine their teaching methodologies and practices in order to facilitate the academic achievement of students from diverse racial, ethnic, cultural, and gender groups. Lastly, an empowering school culture and social structure conceptualizes school as a "social system that is larger than any of its constituent parts such as the curriculum, teaching materials, and teacher attitudes and perceptions" (Banks, 1995, p. 393). Banks suggests reform must be comprehensive, the entire system must be restructured and not limited to certain segments. "Although reform may begin with any one of the parts of a system (such as with the curriculum or with staff development), the other parts of the system (such as textbooks and the assessment program) must also be restructured in order to effectively implement school reform related to diversity" (Banks, 1995, p. 393).

Various other pedagogical approaches and ideologies began to emerge which further expanded the work of James Banks. Such approaches sought to acknowledge and celebrate marginalized students' culture, interests, and identity. They further allowed teachers to implement lessons that generate awareness of social justice issues while motivating their students to have aspirations of a better world for themselves and their communities. For example, according to Phuntsog (1998), a culturally responsive environment recommends teachers are "not content to teach about ethnic groups—they

are responsive to the cultural identity of the learner, as well” (p. 98). Culturally relevant pedagogy (CRP) serves as a bridge between home/community and school cultures, allowing teachers of ethnically diverse populations to incorporate the values, experiences, and perspectives of their students’ cultures into the curriculum (Gay, 2002). Moreover, teachers who implement CRP can “empower students intellectually, socially, emotionally, and politically” (Ladson-Billings, 1992, p. 382). CRP has two primary purposes. First, it seeks to draw upon students’ home cultures as a mechanism for helping them achieve success in school. Secondly, teachers enable their students to think critically about the characteristics of injustices in both schools and the broader society. In other words, CRP is a vehicle for examining social injustices on both a micro and macro level, thereby leading to a more effective implementation of CRP and strategies. Both CRP and SJE, aim to contest negative messages by imparting cultural pride and critical consciousness into students and then empowering them to request a change.

According to Gutstein (2003), social justice pedagogy has three specific goals, including helping students develop 1) a sociopolitical consciousness, an awareness of the symbiotic relationship between the social and political factors that affect society, 2) a sense of agency, the freedom to act on one’s behalf and to feel empowered as a change agent, and 3) positive social and cultural identities. One of the main links between CRP and SJE is the goal of helping to eradicate societal inequities. Critical theorists seek alternatives that allow “individuals to structure their destiny and ameliorate the oppressive nature of the institutions in which they live” (p. 32). Giving “voice” to those who have been silenced by the master narrative is one of the crucial components of critical race theory (Ladson-Billings, 2000). Generally, most theorists agree on the broad principles of SJE, such as these: “1) Equity, the principle of fairness. . . 2) Activism, the principle of agency. . . [and] 3) Social literacy, the principle of relevance” (Ayers et al., 2009, p. xiv).

In the article, “Five Essential Components for Social Justice Education,” Hackman (2005) references L.A. Bell’s (1997) definition of social justice as being a goal and a process: “The goal of social justice education is full and equal participation of all groups in a society that is mutually shaped to meet their needs,” (Bell, 1997, p. 3) while “the process for attaining the goal of social justice . . . should be democratic and participatory, inclusive and affirming of human agency and human capacities for working collaboratively to create change” (p. 4). Hackman (2005) condenses the definition to include student empowerment; the equitable distribution of resources and social responsibility; and her processes to include a democratic, student-centered focus, dialogue, and an analysis of power. SJE examines diversity but also gives careful attention to the systems of power that facilitate privilege and oppression. Both Hackman and Bell agree that, in order for SJE to be effective, students must demonstrate agency both in and outside the classroom. It is important to note that SJE and pedagogy is not to be taught in isolation. It is a concept that can and should permeate most disciplines and works in concert with the goals of other educational theories. Social justice education encourages students to take an active role in their education. Thus, a goal of SJE is to develop a sense of identity and agency among students.

Connie North’s (2009) *Teaching for Social Justice: Voices from the Front Lines* provides a vision for integrating redistribution and recognition in teaching and learning. What kind of learning experiences do children need to become knowledgeable, caring, and active citizens? What should students know and be able to do to become agents for social justice? In response to these questions, North (2009) contended that educators should help all students develop multiple types of literacy to experience academic success in current school settings and contribute to the betterment of society by working toward social justice. North (2009) suggests that “literacy does not mean merely reading and writing skills but includes abilities to engage in a school curriculum fully, as

well as to contribute to building a better community and society” (p.6). North goes on to describe five types of literacy, which include functional, critical, relational, democratic, and visionary.

Lastly, the definition of social justice education offered in *Teaching for Diversity and Social Justice* (Bell, 1997) is frequently cited in contemporary SJE literature and one that greatly influenced my construct of a working definition. The authors view SJE as both a process and a goal. The goal is full and equal participation of all groups in a mutually shaped society to meet their needs. Social justice includes a vision of society in which the distribution of resources is equitable, and all members are physically and psychologically safe and secure. They envision a society in which individuals are both self-determining (able to develop their full capacities) and interdependent (capable of interacting democratically with others). Social justice involves social actors who have a sense of their agency as well as a sense of social responsibility toward and with others and society as a whole (p. 3-4).

Through synthesis of the various theoretical frameworks and pedagogies, my working definition of SJE for this curriculum project consist of the below principles: the process of critically analyzing the systems of power and privilege that give rise to social inequality encourages students to critically examine oppression on institutional, cultural, and individual levels in search of opportunities for social activities with the goal of social change. The secondary goal of social justice education is for students to acquire mathematical literacy in order to investigate and advocate against societal injustices.

### **Why Social Justice Education (SJE)**

*“The educators of this country have much besides content to teach to boys and girls, no matter from what social class they come. They have much to teach through the example of fighting for the fundamental changes we need, of fighting against authoritarianism and for democracy. . . . Our job requires dedication to*

*overcoming social injustice*” (Freire, 1998, p. 103).

The debate over the implementation and issue of social justice education in American public-school curriculum dates back to the early twentieth century. The social reconstructionist movement began in the 1920’s and gained prominence in the early 1930’s, as the United States struggled with a severe economic depression. Social reconstructionists, led by George S. Counts, Harold Rugg, and William Heard Kilpatrick, were the first to specifically include social justice as a purpose and an aim of education. They imagined an activist role for teachers and sought to reform the school curriculum, which they believed should address and, if necessary, act upon current social issues.

The teacher has a pivotal role in the implementation of SJE, as the teacher both serves as a model for social justice and must establish the environment for which it is to emerge in the classroom. First, teachers need a sound content knowledge and to understand how those concepts relate to one another. To be responsive to a diverse population, teachers also need to understand how their students learn and develop in different cultural contexts. Such teachers further need sophisticated pedagogical expertise, including skills for creating learning experiences that build on students’ individual and cultural strengths while engaging them in meaningful and purposeful activities.

Furthermore, and equally important, teachers who are resolved to teach their students equitably need to understand existing barriers to learning that children and youth from low-income and racial/ethnic minority backgrounds consistently encounter in school and in their communities. Culturally specific pedagogy necessitates that teachers learn about their students, their culture, and their backgrounds, which can be achieved by “becoming students of the students” (Leonard, 1998, p. 15). Many people often make the mistake of thinking that, just because we are talking about important and relevant issues, excellent teaching and learning are going on in our classrooms. Unless the math content

itself is strong, even the most provocative conversations and lessons are actually doing students a disservice. It is an act of social *in*-justice to deny young people the opportunity to master the math that they are in your class to learn. Beyond the knowledge and skills identified above, teachers who aim to make a difference in the lives of diverse students need the disposition to teach all learners equitably.

Lisa Delpit (2012) in her book, *Multiplication is for White People*, cites the work of social psychologist Claude Steel. His research on the cause of poor achievement among black students leads him to surmise that the main contributor to poor achievement is their “disidentification” with school (p. 165). Schools are a multipurpose and complex institution; however, it can be generally agreed that the primary purpose of schools is to provide students with the knowledge and skills they will need to become adult citizens. In some cases, our schools are a direct reflection of our society at large. Sadly, the negative perception of black youth and culture in our society infiltrates classrooms and are internalized by these students. Consequently, according to Steel, black students as a means to salvage and maintain a sense of self-worth and pride, are forced to disidentify with the very institution that regards them so poorly. I imagine the same may be true of students from other marginalized communities. Therefore, beyond providing knowledge and skills, teachers who wish to bring social justice into classrooms must not only acknowledge and understand more deeply the conditions of their students’ lives and the sociopolitical dynamics of their world but also encourage an important principle of a SJE—that students themselves are ultimately part of the solution to injustice.

To this end, teachers must pose questions to students to help them address and understand these issues. Freire’s viewpoint would wholly support this form of education because it promotes both problem-posing and student agency. Freire would argue the need for “men and women [to] develop their power to perceive critically the way they exist in the world with which and in which they find themselves; they come to see the

world not as a static reality but as a reality in the process of transformation” which can be achieved by engaging students in authentic lessons and discussions in which they examine their realities and discuss strategies for overcoming academic and societal barriers. (Freire, 2000, p.10). Freire also encouraged “writing the world” (and not just understanding it), which require students to possess a sense of agency, that is, a belief in themselves as people who can make a difference in the world (Freire, 2000, p. 21). Educators can help students develop not only a sophisticated understanding of power relations in society but also the belief in themselves as conscious actors in the world.

Not everyone is in support of SJE; some feel that it has no place in the classroom. In the book, *Class Warfare*, author J. Rochester writes, “there has always been the temptation to use schools for purposes other than schooling, for proselytizing and other ends, since children are the ultimate captive audience” (p. 19). Opponents of SJE suggests that schools should mainly stick to what they are uniquely entrusted to do—teaching subject matter and fostering a love of learning. In an already overcrowded school day in which our schools struggle to find the time to get students to become proficient in “the three R’s,” SJE can be a huge distraction. Schools should not aspire to be churches or social work agencies. Secondly, and more importantly according to Rochester, teachers should be prohibited from promoting a personal political agenda in the classroom. Teachers should keep their ideological dispositions to themselves rather than using their lectern as a bully pulpit. However, SJE proponents and those who support Freire’s viewpoint would look to use their platform or “lectern” as an opportunity to promote critical thinking and agency as opposed to indoctrination (Rochester, 2000, p. 21).

Several case studies and much research has been done to validate not only the need but the effectiveness of SJE. The article, “The Long-Term Effects of Social-Justice Education on Black Students,” shares the results of a research study performed by

Pennsylvania State University in the early 2000s. The focus of the study was to investigate the long-term impact of a transformative social-justice course on black adolescents. Marinda K. Harrell-Levy, an assistant professor of human development and family studies, observed a junior class, predominantly black students who attended an urban parochial high school and who were enrolled in a course whose primary intention was to motivate students to become social agents in their schools and communities. As a course requirement, students had to participate in a service-learning project as well. In 2010, as part of a larger research project, Harrell-Levy followed up with 13 black graduates of the school and, though the sample size was small, she found that the benefits of their mandatory social-justice class extended well into adulthood. Harrell-Levy's goal was to discover how the social-justice class helped a socioeconomically diverse group of black teenagers see themselves in society. What the study revealed was a deep-rooted link between the course, career choices, and the former students' civic and social-justice values. "We know that if you teach ... anything related to civic development, it's very likely that within the next week or two after taking the course, students are going to have a positive feeling about their experiences," she said. "[But] how do they feel ... years later? Is it still resonating?" (Harrell-Levy, 2016, p. 113).

Results indicated that the black alumni of the class, many years after graduating, uniformly credited the social-justice course for provoking a process of self-exploration that altered their sense of justice and influenced their self-identity. Eleven of the 13 reported identifying or revising career interests while taking the course, prioritizing professions to improve their community. Helping convicted felons return to the workforce, pursuing a degree in social work, and working in the education field all flowed from their enrollment in the social-justice class.

An unexpected outcome for the researchers was how the course allowed students to unravel issues of advantage among black students based on class—an aspect that

seldom surfaces in social-justice discourse. The predominately black Catholic school included a mix of students attending through school vouchers, athletic scholarships, academic scholarships, and other financial means. According to Harrell-Levy, the combination offered a unique opportunity for the teachers to challenge intra-racial stereotypes. Participants who described themselves as “privileged” or “sheltered” revealed that their opinions of the “black poor”—and more generally, those living in poverty—were effectively confronted through the social-justice curriculum. “All of these ... thought-provoking conversations made them consider, or reconsider, their own perspective on what it meant to be black. Their own perspective on what it meant to be poor and black. Their own perspective on what it meant to be [economically advantaged] and black. That was a type of conversation that teachers willingly let [happen].” (Harrell-Levy, 2016, p. 101).

Lastly, the Social Justice Standards, found in the Teaching Tolerance Framework, are a set of anchor standards and learning outcomes categorized into four domains—identity, diversity, justice and action (IDJA). The standards provide teachers a common language and organizational structure to guide curriculum development and how to engage in social justice issues. More importantly, the standards provide a clear and concise list of SJE outcomes and goals. In summation, SJE does not merely examine difference or diversity but pays careful attention to the systems of power and privilege that give rise to social inequality, and encourages students to critically examine oppression on institutional, cultural, and individual levels. Ultimately, the intended goal is to produce citizens in search of opportunities for social action in the service of social change.

### **Why Social Justice and Mathematics**

Mathematics teaching and learning through the context of social justice issues is not a new concept. A growing number of researchers and scholars have investigated

teaching mathematics for social justice. Popular among them are Rico Gutstein, Bob Moses, William F. Tate, Marilyn Frankenstein, Gloria Ladson-Billings, and Jacqueline Leonard. In fact, in 1933, author and researcher Leo Brueckner proposed that one of the major goals of education is to provide learners with the opportunity to understand social order and its progression. Since mathematics content is connected to social issues through its quantitative roots, Brueckner (1933) suggested the importance of implementing topics such as financial literacy, national defense, economic organization, distribution of wealth, and improvement of labor conditions in mathematics courses. Many recent studies still emphasize this focus as a major goal of education (Gutstein, 2003, 2006).

From review of its foundational literature, teaching and learning mathematics for social justice (TLMSJ) is based on two fundamental perspectives. First and most prominently, TLMSJ derives from a social-justice-as-critical-consciousness perspective and methodology based largely on the educational theory of Paulo Freire. Several Freirean concepts undergird much of TLMSJ:

- (a) critical focus on knowledge production, (b) a critique of a “culture of silence,” (c) the cultivation of “conscientizaciio” a kind of critical consciousness, (d) a critique of the “banking model of education,” and (e) the promotion of problem-posing pedagogy (Freire, 1998,2000).

At the heart of TLMSJ is a call to rethink and reorient what constitutes mathematical knowledge and what constitutes knowledge production in the domain of mathematics education. Mathematics, perhaps more than any other domain, is (still) regarded generally as neutral, apolitical, or value-free (Nunez, 2015), but for Freire, knowledge is “continually created and recreated as people reflect and act on the world” (Frankenstein, 1983, p. 316).

Furthermore, whether inside or outside of school, mathematics is political in that it is connected to the preservation of privilege, the maintenance of oppression, and the

capacity to see both clearly. For example, while some math textbooks and mainstream curricula are useful for teaching our students mathematics, particularly with real-world contexts, an underlying White middle-class value and viewpoint is present which upholds society's hegemonic status quo. Somewhat intentional or not, this "culture of power," a phrase coined by Lisa Delpit (1988), is filtered through textbooks so that even mathematics representations in textbooks are immersed in the dominant culture. The culture of power represents a set of values, beliefs, ways of acting and being that for sociopolitical reasons, unfairly and unevenly elevate groups of people—mostly white, upper and middle class, male and heterosexual—to positions where they have more control over money, people, and societal values than their non-culture-of-power peers. The images portrayed in textbooks have the ability to influence students' beliefs about self, ethnicity, social class, and gender. Several studies in the 1970s and 1990s documented the lack of equity in mathematics textbooks. The premise is supported by the work of Fan et al. (2013), who scrutinized equity in mathematics textbooks with a focus on gender, race, and ethnicity. The main goal of their analysis was to determine whether or not textbooks have made improvements in their portrayal of the two genders and of different ethnic and racial groups since the 1990s, when prior textbook analyses found that there were still many stereotypes being perpetuated. Three middle school mathematics textbooks series commonly used in the United States were analyzed. Results of the study indicated that while it was evident that an effort was made for all groups to be represented, regarding race and ethnicity, Whites were portrayed as being more mathematical and more active and are shown in more careers than minorities. Furthermore, results also show that adult women and ethnic minorities are still portrayed as more passive. In addition, adult males and Whites are most often depicted as active and, specifically, in a professional setting. Such images are perpetuating the stereotypical notion that White males are supposed to be the active and important members in society.

This portrayal of White male superiority concerns many educators and critical theorists in regard to the messages being sent to our youth pertaining to societal expectations for certain minorities. Thus, Fan et al. (2013), concludes that textbooks ought to be more thoughtful in their selection of images printed and the messages they send to students of color.

Despite the varied approaches in which teachers may implement TLMSJ in their instruction, there exist areas of commonalities among critical theorists and advocates in regard to the benefits of TLMSJ. One is the importance of mathematical literacy and the belief that mathematics has long been a gatekeeper to higher learning opportunities and subsequent economic mobility. Mathematical literacy involves knowing more than the fundamental principles and postulates, and according to Moses and Cobb (2001), “the ongoing struggle for citizenship and equality for minority people is . . . linked to . . . math and science literacy” (p. 14). Carpenter and Lehrer (1999) lists the following as major components necessary for one to develop mathematical literacy: “(a) constructing relationships, (b) extending and applying mathematical knowledge, (c) reflecting about experiences (d) articulating what one knows and (e) making mathematical knowledge one’s own” (Carpenter and Lehrer, 1999, p. 20). According to Leonard et al. (2010), students must know and understand their mathematical identity and experience mathematical socialization in order to become mathematical literate.

Martin (2012) defined mathematics identity as one’s confidence in “(a) their ability to perform in a mathematics context, (b) the importance of mathematical knowledge, (c) constraints and opportunities in mathematical contexts, and (d) the resulting motivation and strategies used to obtain mathematics knowledge” (p. 19). He further writes that “Mathematics socialization describes the processes and experiences by which individuals and collective mathematics identities are shaped by sociohistorical, community, school, and intrapersonal contexts” (p. 19). Applying mathematics in their

everyday lives is one method teachers can use to help students construct their identities.

RadicalMath.org, an online resource for math educators who work to integrate issues of economic and social justice into their math classes, was launched in 2006 by Jonathan Osler. He acknowledges the importance of mathematical literacy and acknowledges that many teachers “continue to use curricula and models that lack any real-world, let alone socially relevant, contexts” (Osler, 2007, p. 1). On the website, he provides a guide for teachers who want to implement TLMSJ but may not know where to begin. Additionally, in the guide as well as the website, Osler lists the benefits of TLMSJ to include student’s ability to

- (a) recognize the power of mathematics as an essential analytical tool to understand and potentially change the world, rather than merely regard math as a collection of disconnected rules to be memorized and regurgitated,
- (b) engage in high-level thinking about big mathematical ideas, (c) deepen their understanding of social and economic issues on local and global scales, (d) understand their own power as active citizens in building a democratic society and become equipped to play a more active role in this society, (e) become more motivated to learn math, and (f) participate in actual (not just theoretical) community problem-solving projects, (g) answer this question for themselves: “Why do I have to know this?” (Osler, 2007, p. 4)

Osler credits scholars such as Bob Moses, Marilyn Frankenstein, and William F. Tate, for their contributions and efforts in integrating social justice in math classrooms. One forerunner of this work is Eric Gutstein, who proposed a theoretical framework for social justice pedagogy that includes the goals of students reading and writing the world with mathematics. He defines *reading the world* as using 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” (2003, p. 45). *Writing the world* entails “using mathematics to change the world,” which is a “developmental process, of beginning to see oneself capable of making change, and . . . developing a *sense of social agency*” (Gutstein, 2006, p. 27). Through his work, Gutstein (2006) has found that his students grew in their ability to understand complex aspects of society in which “mathematics became a necessary and powerful analytical tool that students used to study their sociopolitical existence” (p. 70). Reading and writing the world with mathematics. Gutstein (2003, 2006) examined students’ experience using the objectives of reading the world with mathematics and writing the world with mathematics. These objectives respectively refer to (a) the use of mathematics to develop social consciousness and an understanding of social inequities, and (b) the draw on mathematical knowledge to examine and determine solutions to real-life problems (Gutstein, 2003, 2006).

Despite the theoretical framework of Gutstein and the aforementioned benefits of TLMSJ, there still exists challenges and opponents to this school of thought. Detractors would like to restrict mathematics education to algorithms and numbers, advocating for the separation of math and the social justice perspective. Until recently, embedding mathematics pedagogy within social and political contexts was not a serious consideration in mathematics education. For example, the ordinary act of counting was viewed as a neutral exercise, unconnected to politics or society. “Yet when do we ever count just for the sake of counting?” (Tate, 2013, p. 48). Only in school do we count without a social purpose of some kind. Outside of school, mathematics is used to advance or block a particular agenda. Whether inside or outside of school, mathematics is political. Mathematics teaching and learning are certainly political acts—connected to the preservation of privilege, the maintenance of oppression, and the capacity to see both clearly. Despite increased attention to equity, access, and social justice in mathematics education discourse, there is still great need to clearly and deeply conceptualize these

terms for the purposes of mathematics teaching, research, and development, both professional and curricular.

Critics also cite teacher's lack of preparation and skillset as a reason to deter from TLMSJ. Teachers must possess confidence to facilitate and support the emotions that can arise when curriculum content is introduced that uses mathematics as a tool to understand more about emotionally charged issues. Thus, teaching for social justice can entail conflict, both for teachers and students as well. In particular, it can lead students into what Kevin Kumashiro characterizes as *A Pedagogy of Crisis*, a “paradoxical condition of learning and unlearning in which students are both unstuck (i.e., distance from the ways they have always thought, no longer so complicit with oppression) and stuck (i.e., intellectually paralyzed and needing to work through their emotions and thoughts before moving on with the more academic part of the lesson). Such a paradoxical, discomfoting condition can lead students to resist further learning and to unlearn and therefore may be seen by educators as something to avoid” (Kumashiro, 2002, p. 68).

In addition to possible uncomfortable and uneasy learning environments, opponents to social justice educations in math classrooms cite standardized testing, mandated curriculums, and time as additional reasons to focus solely on math content without the social justice perspective. Local, state, and national accountability measures make it challenging to avoid teaching to the test, and it takes time to create a curriculum other than what is provided. Many schools have textbooks that they require their teachers to use. This is both a local and national battle. If teachers veer to teach something other than what they are told to teach, they suffer possible repercussions of making that decision.

Secondary school teachers often encounter the questions “When am I ever going to use this?” and/or “Why do we need to learn this?” (Otten, 2011) in their mathematics classroom. Otten (2011) posits that secondary mathematics teachers often combat such

questions by informing students about real-world situations in which one would use mathematics: professions that require a foundation in mathematics, mathematics that underlies technology, and future mathematics learning that students will experience. Other teachers hold and share with learners their belief that mathematics concepts do not necessarily need an immediate real-world connection. According to Brelias (2009), traditional mathematics applications in the classroom merely represent attempts to connect mathematics and the real world. While mathematics educators strive to bridge content to real-life applications in order to engage students in mathematics learning, some argue that attempting to find and connect the subject to the real world could mislead students into believing that there is always a real-life application for any given mathematics concept. This attempt to attach every concept to real life may result in problems and applications that are contrived, leading students to feel a further detachment of mathematics to the real world (Otten, 2011). Similarly, Boaler (1993) argued that contexts that are intended to provide a real-world dimension to classroom mathematics tend to distance the subject further from real life because these problems tend to be fabricated and overly simplified for students to follow a specific algorithm in determining the solution. Therefore, I caution those who desire to integrate social justice pedagogy and instruction into their classrooms do so knowing that it may not be expedient to transform every lesson into one for the very reasons just described. Quite frankly, there exist math concepts that are difficult and rarely connect to those encountered in life and merely represent “real world associations” (Boaler, 1993, p. 14). In fact, very few of them are relevant to marginalized sects of young people, and they do not have students investigate issues of social justice.

### **Case Studies**

Achieving equity in mathematics education is a fundamental challenge facing mathematics educators (Principles and Standards - National Council of Teachers of

Mathematics, 2000). Thus, mathematics education faces a two-fold imperative: to provide students with mathematics instruction that includes the mathematics-specific goals deemed necessary for success in the current system while simultaneously providing students an opportunity to use mathematics to expose and confront obstacles to their success (Gutiérrez, 2002; Gutstein, 2003). In order to gauge the TMSJ effectiveness, it is important to analyze the matter from varying perspectives. In this section I will present two case studies that explore TMSJ from two perspectives, 1) teacher and 2) students.

One such scholar is Rico Gutstein (2003) whose work models the marriage of social justice and mathematics. In his study, Gutstein's role was that of a practitioner-researcher who taught twenty-one Grade 12 college preparation mathematics students from a low-income community. A similar two-year study was conducted by Gutstein (2003) as he played the role of a Grade 7 teacher, who became the Grade 8 teacher for the same group of 26 students in a school located in a Mexican American community in a midwestern city of the United States. Both studies involved the goal of empowering students who are experiencing the immediate consequences of particular social issues by integrating data about these issues into their mathematics classes. Similar data collection methods were used in both studies: observations, artifacts from students' work, and student questionnaires. Teaching mathematics in the context of these topics allowed Gutstein (2003) to observe that it is the context of social justice issues, rather than the mathematics content, that drove the curriculum. For instance, the context of social issues such as fairness in the election process drove students to pose their own questions about fraud in election results. Their questions then led to exploration of whether the irregularities in the election outcomes were coincidental. Gutstein (2003) concluded that the student-selected topics supported his students in developing the skills to write and "read the world using mathematics" (Gutstein, 2003, p. 49). In terms of reading the world with mathematics, students demonstrated their use of mathematics to understand social

inequities (Gutstein, 2003). This was found in students' participation in the activities as they formulated questions, made conclusions from data, and discussed social phenomena to explain their findings (Gutstein, 2003). In terms of writing the world, students showed a sense of responsibility in remediating social inequities as they expressed in a student survey the need to take part in "combat[ing] against oppression and injustice in our communities and in the world" (Gutstein, 2003, p. 37). In this study, students appeared to have learned to use mathematics to make judgements about the real world (Gutstein, 2003).

Anastasia Brelias (2009) reported similar outcomes in her doctoral dissertation. The study sought to examine the use of socially relevant mathematics applications in two separate urban high schools in the midwestern United States. She observed the classroom environment as well as the students' views of mathematics in light of their experiences with these applications in Statistics and Mathematical Modeling. Specifically, the study focused on investigating the nature of the inquiry in social justice mathematics and students' views of using mathematics as a tool for social inquiry. The mathematics content of the courses was connected to social issues through the following socially relevant applications: the death penalty, social security, distribution of income, environmental pollution, scarcity of resources such as health vaccines, and equity in school funding. Through these contexts, students were asked to generate a hypothesis prior to working with numerical data, use mathematics to investigate the issue, explore the implications of their findings, and discuss possible explanations for their findings.

From Brelias's (2009) observations, students concluded that racial bias was found to be associated with death penalty execution. Using data from observations and interviews, she also reported that such activities allowed students to choose specific mathematical tools to explore social inquiry. When looking into social justice issues, the problems formulated by the teacher and the students allowed students to explore different

ways to represent situations mathematically. Furthermore, findings indicated that drawing conclusions from their hypotheses testing was not always simple. Thus, the researcher asserted that these applications allowed the integration of “ambiguity, complexity, and uncertainty” (Brelia, 2009, p. 256), which tend to be characteristics of problems in real-life. By having these characteristics reflected in the investigations, Brelia (2009) found that students’ common misconception that mathematics is “certain, objective, neutral, and value-free” (p. 256) was challenged.

Referring to the activity of questioning the equity of the death penalty, students felt that the issue was too complex to be objectified and answered by challenging whether there is fairness in execution. This example suggested that students recognize that mathematics is not necessarily a definitive tool for answering moral and ethical questions. The researcher concluded that students recognized the limitations of mathematics as an inquiry tool for investigating social issues. These limitations include the oversimplification of the issue, objectification of human beings, irrelevance for moral and ethical questions, and inadequacy in explaining social problems (Brelia, 2009). Despite recognizing these limitations, students felt that mathematics is valuable in initiating investigations about social justice issues. These results showed that students learned the value of mathematics as a tool in uncovering social inequalities, which could lead to social change (Brelia, 2009). From observation data, Brelia (2009) drew rich findings regarding the nature of students’ participation in activities that integrated mathematics with social justice issues.

### **Conclusion**

Education is linked to economic, political, and social power structures that can perpetuate inequity in schools (Apple, 1992). Considering these structures in relation to education and the call for equity in mathematics education entails a shift from thinking about preparing students to live within the world, as it currently exists, to thinking about

preparing students to develop a sense of agency to seek opportunities to dismantle institutions or social constructs that promote oppression and injustices. Teaching and learning mathematics for social justice has its roots in the mathematics education and build on work in critical pedagogy, in particular, Freire's (2000, 2006), draws upon culturally relevant pedagogy (Ladson-Billings, 1994) and James Banks' (1995, 1997) framework for multicultural education that not only sought to achieve educational equity for all students, regardless of race, gender, or culture. TMSJ provides students an opportunity to use mathematics to expose and confront obstacles by using mathematics to study and critically analyze their world to ultimately promote a democratic society in which all get an opportunity to participate fully.

Teachers who seek to teach in this manner must realize that incremental steps are necessary. Although the potential TMSJ has for addressing issues of equity in mathematics education, little research exists that examines math teachers learning to teach for social justice, a necessary step in beginning this approach. Furthermore, the constraints of curriculum mandates and standardized testing may impede the process as well. It is recommended to those who dare to venture in TMSJ start with social issues that are relevant to their student population and find ways where the mathematics content may align. It may be more productive to begin with a lesson or two before delving into a study unit. Just like math teacher's learning to teach for social justice may be limited, the same may exist for students. Teachers must construct guidelines to introduce students to exploring what may be socially and emotionally charged topics in a math classroom.

Freire (1994) speaks to a spirit of hope and reminds us that hope comes with the struggle for a brighter future based on new relations between people. He wrote that without hope, the struggle dissipates – but without the struggle, hope is meaningless and does not change reality. They need each other. To build on what the aforementioned education theorists and reformists have done, to reinvent, and to use the knowledge of

students and their communities bring as a source for developing and teaching critical mathematics curriculum is a contribution we can make – that is, to make mathematics be a weapon in the fight for social justice and a better world.

### **Introduction to Curriculum Unit**

According to NCTM's Principles and Standards (2000), students should engage in activities that require them to reason, communicate, represent, problem-solve, and make mathematics connections. To this end, teachers must pose authentic problems that require high cognitive demand and “expand beyond everyday classroom experiences” (Tate, 1995, p. 168). “The Bare Minimum about Minimum Wage” is a five-lesson unit plan situated in the social justice issue of our country's minimum wage (see Appendices A, B, C, D, and E). The unit is appropriate for students who are enrolled in an Algebra course, particularly eighth- and ninth-grade students. Students will analyze real-world data about the United States hourly wage in comparison to a family's cost of housing per month, specifically for the Memphis metropolitan area. Students will mathematically model and analyze various linear representations and make connections between graphs, tables, and systems of equations. To discover the difference between the minimum wage and a living wage, student groups will also calculate the hourly wages necessary for a family in Memphis to afford housing and decide if families are paid fair wages or not. As a final product, students will assume the role of activists and present an argument, either in favor of an increase to the minimum wage or not, using their preferred medium (e.g., literary poem, video of a public service announcement, letter to legislature).

An essential component of the unit is to have students not only explore sociopolitical issues but also develop a voice for student activism to cause political, economic, or social change. Art is a natural way for children to express their feelings and ideas, and art and activism go hand-in-hand. The arts are among the most powerful tools

we have for communication and unifying people to stand together or to call attention to societal ills. Art can be the first step in an activist movement, and students can express themselves in the form of banners, posters, sculptures, musical concerts, public performances, photography, and films. Literature can also serve as a medium for social and political activism. As the unit is designed to provide students the opportunity to relate mathematics to their lives through real-world scenarios, it is also intended to connect mathematics to artistic expression. One such way is through literature, mainly through poetry. Infusing literature in math instruction shows students how mathematics exists in our world, and “this mathematics-literature connection is a natural way for teachers to allow students to see mathematics in everyday society, to give meaning to mathematics, and to make it come alive” (Leitze, p. 398). For these reasons, I incorporated the poem by Shahin Shabanian entitled “Minimum Wage” (see Appendix F). Shabanian is a poet and member of the organization, Creative Resistance, whose goal is promoting and supporting activist art. “Minimum Wage” will be utilized as a literary introduction and a mentor text of art and activism. The goal is to provide students a model they could emulate in crafting their piece in they so choose to present a poem as a final product.

Lastly, it is necessary to note that in a real-world context, teaching mathematics through a social justice perspective is most beneficial when students have the liberty to select an issue that resonates with them. In the development of this unit, the topic of minimum wage was selected because generally it is during high school years that most young people begin to seek employment—their first job. Yet, a 2020 report by the Resolution Foundation shows that the number of teenagers with jobs is plummeting. Young people are now waiting two years longer to enter the workplace than two decades ago, bringing the average age for a person to start their first job up from 16 to 18. The reason cited for this change is that more teens are choosing to devote their time to academic study (Dickler, 2019). The unit will require students to survey their peers to

validate this claim. More importantly, according to Delavega and Blumenthal (2019), the city of Memphis has a poverty rate of 27.8%. The poor in Memphis tend to be minorities. The poverty rates for Blacks and Latinos are higher than the overall poverty rate. It appears that Memphis continues to have an increased poverty rate which impacts student's lives in some way, which is the basis for selecting this topic. The unit will provide students the opportunity to explore the reasons that contribute to Memphis's perpetually high poverty rates. I do encourage teachers to either utilize a student inventory questionnaire or create a method to assess students' areas of interest to identify their students' areas of interests before embarking on a social justice mathematics project. Doing so is very important because students are more likely to engage with material they have identified as important rather than an issue chosen for them.

### **Overview and Historical Context**

In 1938, President Franklin D. Roosevelt passed the Fair Labor Standards Act (FLSA) as part of the New Deal. The FLSA set the first U.S. minimum wage at \$0.25/hour primarily to protect workers during the Great Depression when, due to fierce competition, companies had to decrease pay and extend hours just to stay in business. Wages drastically plummeted to pennies a day. Since 1938, the United States' Congress has raised the minimum wage twenty-two times. The most recent amendment to the FLSA was the Fair Minimum Wage Act of 2007. During 2007 and 2009, Congress set scheduled increases to its current amount of \$7.25 per hour.

Proponents of a higher minimum wage state that the current federal minimum wage of \$7.25 per hour is too low for anyone to live on; that a higher minimum wage will help create jobs and grow the economy. Furthermore, supporters of an increased minimum wage suggest that the declining value of the minimum wage is one of the primary causes of wage inequality between low- and middle-income workers. The minimum wage roughly meshes with federal poverty guidelines. According to the

guidelines, a two-person household with a total annual income below \$16,910 is considered to be living in poverty. To clear the poverty line, one of those two people would have to make \$8.13 an hour or more (Ravenscraft, 2019). The minimum wage should provide enough income to afford a living wage, the amount of income determined to provide a decent standard of living—enough food, clothing, and shelter. The living wage should also be adjusted to compensate for inflation. The purpose of a living wage is to make sure that all full-time workers have enough money to live above the federal poverty level.

However, opponents say that many businesses cannot afford to pay their workers more, and will be forced to close, lay off workers, or reduce hiring; that increases have been shown to make it more difficult for low-skilled workers with little or no work experience to find jobs or become upwardly mobile; and that raising the minimum wage at the federal level does not take into account regional cost-of-living variations where raising the minimum wage could hurt low-income communities in particular.

### **The Memphis Context**

Poverty in the U.S. continues to drop, but it appears that the Memphis area is going in the opposite direction in poverty. It continues to be true that the minimum wage has not increased since 2009, and that has important implications for poverty. A worker making the minimum wage of \$7.25 an hour, if working 40 hours a week year-round (52 weeks), will earn \$15,080 before taxes. The poverty threshold for a family of two was \$16,460 in 2018, thus rendering even a small family of a mother and child under poverty (Delavega & Blumenthal, 2019).

One possible explanation is that the labor market in Memphis tends to consist of unskilled workers in the warehouse industry. The lack of comprehensive, effective, and efficient public transportation also makes progress against poverty very difficult. Finally, the divide between the city and the county, as evidenced by the racial and geographical

differences in poverty, tends to deprive the city of Memphis of the funds it needs to support the region (Delavega & Blumenthal, 2019). According to the Tennessee Department of Education (TDOE), Shelby County Schools enrolls 106,377 students, nearly seventy-seven percent are Black or African American and approximately fifteen percent are Hispanic or Latino Students. Nearly sixty percent are identified as 'Economically Disadvantaged Students' which is defined as a student whose household income is below average. This topic directly impacts the students who are more likely to engage in this unit and will provide students the opportunity to explore the reasons that contribute to Memphis's constantly high poverty rates.

## Appendix A

**Unit:** The Bare Minimum about Minimum Wage, Lesson One

**Subject:** Algebra One

**Grade:** Ninth Grade

**Time Limit:** 90-minutes

### **Standards**

#### **ELA:**

- CCSS.ELA-LITERACY.RL.11-12.7  
Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)

#### **Social Justice:**

- JU.9-12.12 (Justice)  
I can recognize, describe and distinguish unfairness and injustice at different levels of society.
- JU.9-12.13 (Justice)  
I can explain the short and long-term impact of biased words and behaviors and unjust practices, laws and institutions that limit the rights and freedoms of people based on their identity groups
- AC.9-12.17 (Action)  
I take responsibility for standing up to exclusion, prejudice and injustice.

#### **Objectives:** Students will be able to:

- Read and comprehend literature, including poems.
- Define social justice

#### **Materials Needed**

- Powerpoint (see attached)
- Handout- Poem and Activity Sheet
- iPads (for research)

#### **Introduction**

Lesson One is an introduction to the intersection of social justice and mathematics. Because most students have not had the experience to learn math in this manner, much attention is given to exploring social justice and its connection to their lives. The PPT guides students through an in-depth explanation of social justice. The students also analyze artistic expressions of various social justice topics, which will help prepare them to produce a final product at the end of the unit.

### **Instructional Sequence (90 minutes)**

- Do Now (5-8 minutes)  
Slide 2 on PPT.
- Class Discussion and Activity (65 minutes)  
Project PPT and go through slides. Each slide had detailed notes to help guide the discussion.  
Slide 12- Distribute handouts of the “Minimum Wage” poem and the activity sheet.  
Also distribute iPads so students will be able to research the websites about minimum wages and FY 2019 Fair Market Rent. The information will be needed for the next lesson (the mathematics).
- Closure- Exit Ticket (5 minutes)  
Slide 13 on PPT

### **Assessment**

Exit Ticket \$2.00 Summary

I selected this form of an exit ticket to gain insight into the student’s understanding of social justice. The feedback will also help inform instruction for the next lesson. If necessary, I may need to explain in greater detail the concept. Also, I selected the \$2 Summary because of its review of basic skills but also because it allows students to practice writing their thoughts in a concise manner (no more than twenty words).



DO NOW:

- What is your initial reaction to this image?
- What message do you think the artist is trying to convey?

Support your claim using details from the image.

A close-up photograph of a person's face, looking upwards. The person's skin is dark. Overlaid on the face is a semi-transparent image of the United States flag, with the stars and stripes clearly visible. The person's eyes are looking upwards, and there are some red marks on their face, possibly from the flag's stripes. The image is set against a background of lined paper, suggesting a worksheet or notebook.

## TODAY'S AGENDA

- Activities will help students:
  - define unjust law and question why some inequities remain legal
  - analyze photographs that show people confronting unjust laws
  - recognize that photographs are not merely reflections of reality but mediated images that convey many meanings
  - analyze another form expression to confront unjust laws

## GUIDING QUESTIONS;

- What is an unjust law?
- How do people protest such unjust laws?
- How can artistic expression show protests?

## WHAT IS SOCIAL JUSTICE ?

"SOCIAL JUSTICE MATH" which involves working with real numbers to solve real problems.

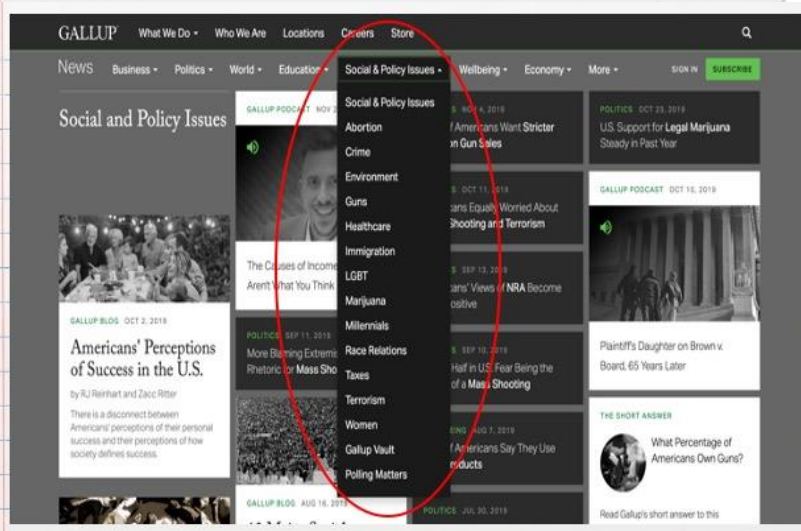
Students discuss the ideas about learning mathematics through a social justice lens. They feel empowered that they as individuals can make a difference.

WHY ARE WE TALKING ABOUT  
THIS IN MATH CLASS?

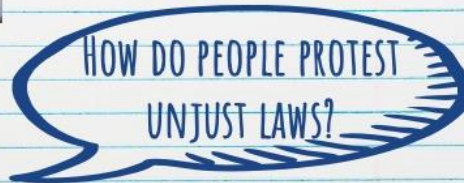
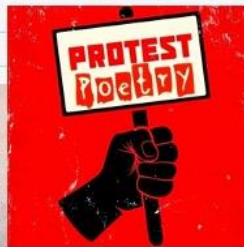
## IS THERE A SUCH THING AS EQUALITY?

*Equality* is one of the ideals on which the United States is based. Unfortunately, the country—and its laws—has not always lived up to that ideal.

*Example:* The tension was evident in the Constitution itself, when Northern and Southern states agreed to do nothing about slavery and to count each African American slave as 3/5 of a person for purposes of representation and taxation. Such injustices, are seen by many as unjust laws.



## HOW CAN ARTISTIC EXPRESSION SHOW PROTESTS?



**SOCIAL JUSTICE ISSUE:**  
**RAISE THE MINIMUM WAGE**  
**A CRY FOR JUSTICE FOR AMERICA'S**  
**LOW WAGE WORKERS**

National Minimum Wage	
Pros	Cons
<ul style="list-style-type: none"><li>• Increases income of low-paid</li><li>• Improves labour productivity – workers more motivated</li><li>• Firms have more incentive to invest in labour productivity</li><li>• Can offset impact of monopsony employers</li><li>• Increases incentive for people to enter labour market and accept job</li></ul>	<ul style="list-style-type: none"><li>• Can cause unemployment in competitive markets</li><li>• Could encourage use of black markets</li><li>• Some firms cannot afford the wages.</li><li>• Could lead to higher prices as firms pass on wage increases.</li><li>• Regional imbalances in wages reduces the effectiveness</li></ul>

# A PICTURE IS WORTH A THOUSAND WORDS

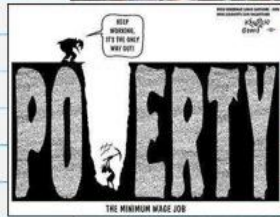
11



## Minimum Wage

*The goal. Raise and index the minimum wage*

*"There is nothing but a lack of social vision to prevent us from paying an adequate wage to every American whether he [or she] is a hospital worker, laundry worker, maid, or day laborer."*  
— The Rev. Dr. Martin Luther King, Jr.



12



## Poem: Minimum Wage

By Shahin Shabanian

### Minimum Wage

Minimum Wage deserves a rage:  
The Market has placed us in a cage.  
We should muster our courage:  
A Living Wage is needed for this age  
And our solidarity is on the same page.  
Minimum Wage doesn't pay the rent  
But we are told to relent.  
Eat grass, drink rain, live in a tent,  
Work hard and be content.



# EXIT TICKET

Name \_\_\_\_\_

## \$2.00 Word Summary

Write a summary about what you learned during the lesson. Each word costs \$0.10. Do not go over \$2.00.

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## Appendix B

**Unit:** The Bare Minimum about Minimum Wage, Lesson Two

**Subject:** Algebra One

**Grade:** Eight/ Ninth Grade

**Time Limit:** 90-minutes

### **Standards:**

- CCSS.MATH.CONTENT.HSA.CED.A.2  
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- CCSS.MATH.CONTENT.HSA.CED.A.3  
Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

### **Mathematical Practices**

1. Make sense of problems and persevere in solving them.
2. Construct viable arguments and critique the reasoning of others.
3. Model with mathematics.
4. Use appropriate tools strategically.
5. Attend to precision.

**Objectives:** Students will be able to

- *Make connections between graphs, tables, and equations by identifying slope and y-intercept in each representation*
- *Recognize that two non-parallel lines have a point of intersection and that point is a solution for the equations of both lines*

### **Materials Needed**

- Handout
- Graph Paper, 11" x 17" size
- Color pencils
- iPads (for research)
- Ruler

- Families cards

*Adapted from College Preparatory Mathematics, Mathematics 1, Second Edition, 2002*  
[https://www.shastacoe.org/uploaded/SCMP2/Fall\\_Content\\_Day\\_10-28-14\\_3-5/Winter\\_Content\\_Days\\_February\\_3\\_and\\_4,\\_2015/3\\_5\\_The\\_BIG\\_Race\\_copy.pdf](https://www.shastacoe.org/uploaded/SCMP2/Fall_Content_Day_10-28-14_3-5/Winter_Content_Days_February_3_and_4,_2015/3_5_The_BIG_Race_copy.pdf)

### **Introduction**

Students were able to investigate and explore the topic of minimum wage through online research. Students began to form an opinion based on this preliminary research. Today's lesson is designed for students to mathematically decide if minimum wage is a 'fair' wage or not based upon different real-world scenarios. Students will begin to work independently, analyzing their individual scenario, and then work in collaborative groups to complete the final task.

### **Instructional Sequence**

Do Now (5-8 minutes)

Students must calculate the slope and verify their answer using the rise/run method on graph paper.

**Find the slope of the line through each pair of points.**

1)  $(19, -16), (-7, -15)$

2)  $(1, -19), (-2, -7)$

## Do Now (Answer Key)

$$\begin{array}{l} 1. \quad (19, -16) \quad (-7, -15) \quad m = \frac{y_2 - y_1}{x_2 - x_1} \\ \quad \quad x_1 \quad y_1 \quad x_2 \quad y_2 \\ m = \frac{-15 - (-16)}{-7 - 19} \\ \quad \quad = \frac{-15 + 16}{-26} \\ \quad \quad = \frac{1}{-26} = -\frac{1}{26} \end{array}$$

$$\begin{array}{l} 2. \quad (1, -19) \quad (-2, -7) \\ m = \frac{-7 - (-19)}{-2 - 1} \\ \quad \quad = \frac{7 + 19}{-2 + -1} \\ \quad \quad = \frac{26}{-3} = -\frac{26}{3} \end{array}$$

Whole Group Discussion (10 minutes)

Teacher will introduce the learning task, providing in-depth instructions. One scenario has been provided so students will visually understand the expectations. Teacher will model the process (think aloud) of the constructing an equation and representing the equation graphically.

Independent/ Group work (60 minutes)

Students will work to complete the learning task.

### Assessment

Students will be assessed based on their individual work, Task 1, as well their participation and final product of the group assignment, Task 2. Student work must be mathematically correct, and students must show their computations. The final graph will also be assessed for accuracy.



## What's a Fair Housing Wage? **ANSWER KEY**

Today your group will figure out the hourly wage necessary for a family in Memphis to afford housing. Generally, families spend a minimum of thirty percent of their monthly income on housing/mortgage. You will look at **real data** about hourly wages (the amount of money you make per hour, minimum wage) and the cost for renting each month.

**Your goal is to use mathematics to decide whether or not you think six families in Memphis are paid fair wages.**

Task 1: Visit the website:

[https://www.huduser.gov/portal/datasets/fmr/fmrs/FY2019\\_code/2019summary.odn](https://www.huduser.gov/portal/datasets/fmr/fmrs/FY2019_code/2019summary.odn)

Here, you will find the 2019 Fair Market Rents for metropolitan areas. This information is provided by the Federal Government, The U.S. Department of Housing and Urban Development (HUD). Complete the chart below:

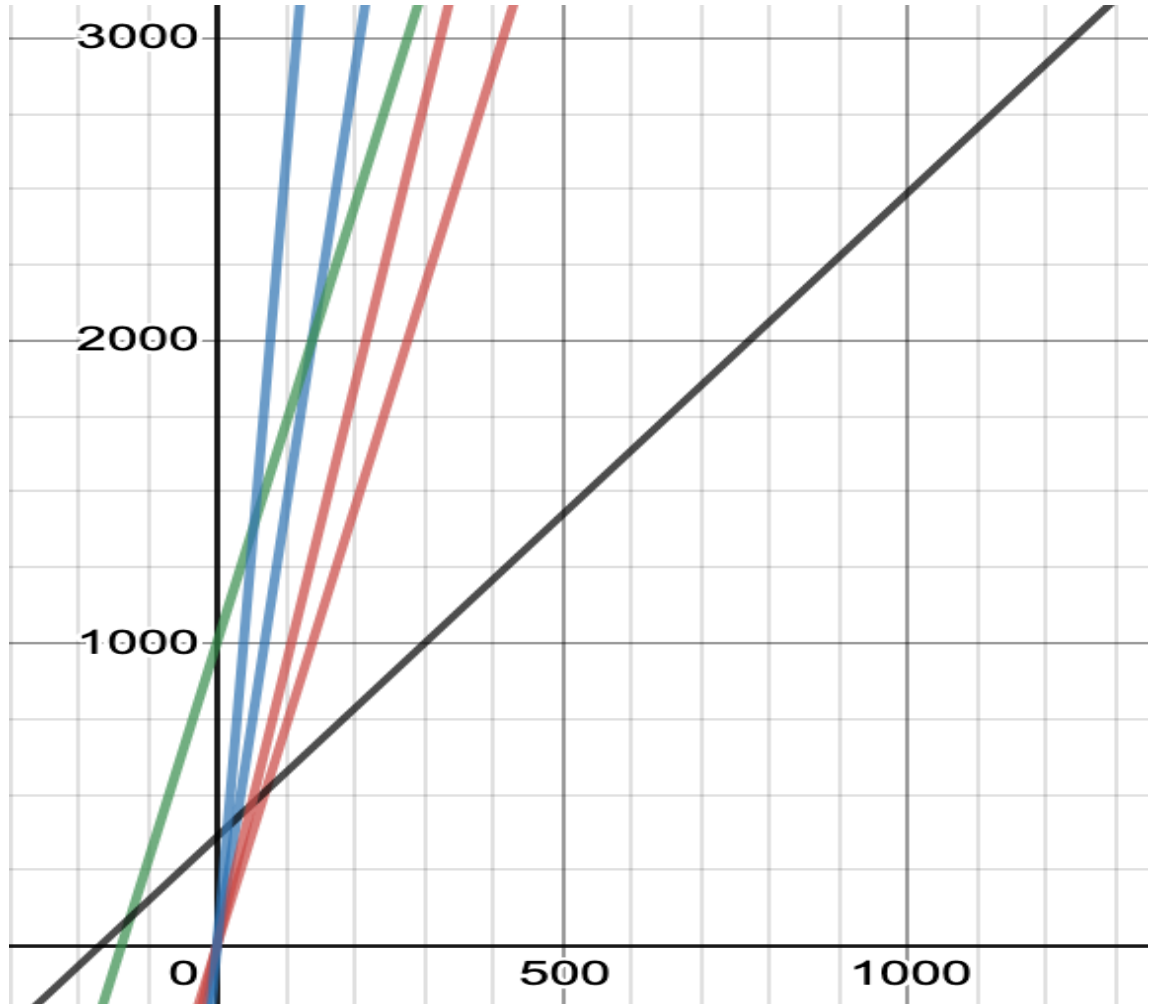
Studio	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom
<b>\$704.00</b>	<b>\$794.00</b>	<b>\$936.00</b>	<b>\$1,277.00</b>	<b>\$1,467.00</b>






With the information provided on your card, answer the following questions:

1. Write an equation in the form of  $y = mx + b$  for your family. What does  $y$  represent in the equation?  
 $y$  represents the amount of money each earns per week
2. What does slope represent in this problem?  
 $m$  represents the hourly rate paid per hour
3. What does the  $y$ -intercept represent?  
The  $y$ -intercept represents any additional income
4. What does the  $x$ -intercept represent?  
There is not a  $x$ -intercept because the slope is positive representing money earned on a weekly basis

5. Graph the equation on the coordinate plane. How do you set up the coordinate plane, i.e. what quadrants are needed to represent your scenario? What is your scale for the x- and y- axis? Why did you choose this value?

Only the first quadrant is needed. See below.



- |   |   |                    |
|---|---|--------------------|
| 1 |  | $y = 7.25x$        |
| 2 |  | $y = 14.50x$       |
| 3 |  | $y = 7.25x + 1000$ |
| 4 |  | $y = 2.13x + 360$  |
| 5 |  | $y = 9.28x$        |
| 6 |  | $y = 26x$          |

<p style="text-align: center;"><b>RED Family</b> 1 adult</p> <p>You are a Filipino American male who just graduated from high school and needs to move out on your own. You found a job making minimum wage for non-tipped employees in Memphis- \$10.50 per hour - as a line cook at a nearby restaurant. You work 40 hours per week.</p> <p><math>y = 7.25x</math>  <b>Weekly amount: \$290.00</b>  <b>Monthly income: \$1,160.00</b>  <b>Studio rental @ \$704.00</b>  <b>Total amount after rent- \$456.00</b></p>	<p style="text-align: center;"><b>GREEN Family</b> 1 adult; 1 child</p> <p>You are a young single white mom with one child working as a server at a nearby restaurant. Minimum wage is different if you receive tips - \$5.95 per hour. You make minimum wage, and you average about \$360 per week in tips. You work 40 hours per week.</p> <p><math>y = 2.13x + 360</math>  <b>Weekly amount: \$445.20.00</b>  <b>Monthly income: \$1,525.20</b>  <b>2-Bedroom rental @ \$936.00</b>  <b>Total amount after rent- \$589.20</b></p>
<p style="text-align: center;"><b>BLUE Family</b> 2 adults; 2 children</p> <p>You are a Latino family with two children under the age of 5. You can't afford to put both children in childcare. Mom stays home to take care of the children. Dad works 40 hours per week at a construction company that pays 2 times minimum wage for non-tipped employees.</p> <p><math>y = 14.50x</math>  <b>Weekly amount: \$580.00</b>  <b>Monthly income: \$2,320.00</b>  <b>2-bedroom rental @ \$936.00</b>  <b>Total amount after rent- \$1,384.00</b></p>	<p style="text-align: center;"><b>YELLOW Family</b> 1 adult</p> <p>You are a young Black woman who is going to school part time and working full time (40 hours per week). You work at the same construction company as the dad of the BLUE family, but most Black women (including you) make 64% what men at the company make.</p> <p><math>y = 9.28x</math>  <b>Weekly amount: \$371.20</b>  <b>Monthly income: \$1,484.80</b>  <b>Studio rental @ \$704.00</b>  <b>Total amount after rent- \$780.80</b></p>
<p style="text-align: center;"><b>ORANGE Family</b> 1 adult</p> <p>You are a Palestinian American female who is a full-time student working about 20 hours per week. You have a minimum wage job working in the library (no tips). But you got a scholarship, so you get \$1000 at the beginning of every month.</p> <p><math>y = 7.25x + 1000</math>  <b>Weekly amount: \$290.00</b>  <b>Monthly income: \$2,160.00</b>  <b>Studio rental @ \$704.00</b>  <b>Total amount after rent- \$1,456.00</b></p>	<p style="text-align: center;"><b>PURPLE Family</b> 2 adults; 2 children</p> <p>You are a Black family with two children. Both of your children are in school, so both adults work full time (40 hours per week). Both found jobs working for Amazon. Amazon pays employees \$13 per hour.</p> <p><math>y = 26x</math>  <b>Weekly amount: \$1,040</b>  <b>Monthly income: \$4,160.00</b>  <b>3-Bedroom rental @ 1,277.00</b>  <b>Total amount after rent- \$2,883.00</b></p>

**Task 2** - As a team, do the following:

Figure out how many hours each family needs to work to pay rent for the type of apartment you think is best for the family.

**Guidelines:**

- Draw a graph & write an equation for each family's earnings over time
- Use a different color pencil/marker for each family
- Identify the dependent and independent variables
- Use this data to about fair housing rental prices for monthly rent:

Data source: [Huduser.gov](http://Huduser.gov)

- Your team must work cooperatively to solve the problems. No team member has enough information to solve the problems alone!
- Each member of the team will select a family - Red, Green, Blue, Yellow, or Orange. **DO NOT SHOW** your card to your team. You may only communicate the information on the card.
- Everyone can see the PURPLE family card.
- Assume there are 4 weeks in one month.
- You might not need to use all the information on your card to solve the task.

## Appendix C

**Unit:** The Bare Minimum about Minimum Wage, Lesson Three

**Subject:** Algebra One

**Grade:** Eight/ Ninth Grade

**Time Limit:** 90-minutes

### **Common Core Standards**

- **W.9-10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- **W.9-10.1a** Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
- **L.9-10.1** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

### **Mathematical Practices**

6. Make sense of problems and persevere in solving them.
7. Construct viable arguments and critique the reasoning of others.
8. Model with mathematics.
9. Use appropriate tools strategically.
10. Attend to precision.

**Objectives:** Students will be able to

- synthesize the knowledge gained over the unit of the lessons, including honest reflection on the challenges in relating mathematics and art to activism.

### **Materials Needed**

- None

**Introduction:** (5 minutes)

Today's instructional block has been set aside for students to begin creating their final product of artistic expression. Students can refer to prior examples of artistic expression or the mentor text, the poem "Minimum Wage" as a catalyst to begin.

Explain to students that they will be presenting their art expression to their classmates during the Socratic Seminar.

**Instructional Sequence:** (80 minutes)

Workshop- Students can begin constructing their final product. I will be available to ask me questions or offer feedback if students are not sure about which direction you should go or need a jump start.

It is important to stress that students should use their time wisely. Students should allow time for revisions, particularly if their product is a literary piece.

It is also important to stress that students should take advantage of time outside of class to complete the task.

**Assessment**

Check-in with each student. I will meet briefly with each student to monitor the progress they have made and offer suggestions as needed.

## Appendix D

**Unit:** The Bare Minimum about Minimum Wage, Lesson Four

**Subject:** Algebra One

**Grade:** Eight/ Ninth Grade

**Time Limit:** 90-minutes

### **Common Core Standards**

- W.9-10.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- **W.9-10.1a** Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
- **L.9-10.1** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

### **Mathematical Practices**

11. Make sense of problems and persevere in solving them.
12. Construct viable arguments and critique the reasoning of others.
13. Model with mathematics.
14. Use appropriate tools strategically.
15. Attend to precision.

### **Objectives:** Students will be able to

- synthesize the knowledge gained over the unit of the lessons, including honest reflection on the challenges in relating mathematics and art to activism.
- reflect on how our thinking about activism has changed or evolved.
- set goals for carrying these lessons with us in future endeavors.

### **Materials Needed**

- chart paper
- markers
- Powerpoint Slide show (attached, “Gallery Walk.Lesson 4.FINAL”)

### **Introduction**

This lesson provides the space for students to reflect on what they have learned and how they will turn their knowledge into action. More importantly, I want students to be able to see the natural intersection of mathematics and social justice.

Students will be asked to consider what the purpose might be for reflecting over what they have learned and accomplished while thinking about the relationship between mathematics and social justice/activism. Explain that reflection will give them a chance to feel proud of themselves and also set individual goals moving forward. They will also have a chance to understand their classmates' experiences of the same activities and feel as if they are part of an active learning community.

### **Instructional Sequence**

- Do Now (5-8 minutes)- **Refer to powerpoint, slide 2**  
Prompt: What does “activism” mean to you now?
- Key vocabulary (5 minutes)- **Refer to powerpoint, slide 5**  
Remind students about key vocabulary terms applicable to this unit
- Why Reflect (5 minutes)- **Refer to powerpoint, slide 6** (notes are also on the ppt slide)

Ask students to consider what the purpose might be for reflecting over what they have learned and accomplished while thinking about the relationship between math and social justice. Students should be able to defend their position, being an advocate or opposer for a minimum wage increase. Their justification should be based on the mathematics and group discussions from lesson 2.

Explain that reflection will give them a chance to feel proud of themselves and also set individual goals moving forward. They will also have a chance to understand their classmates' experiences of the same activities and feel as if they are part of an active learning community.

- Gallery Walk Instructions (60 minutes) **Project powerpoint, slide 7**

Begin by introduce instructions for the Gallery Walk. Inform students that pieces of chart paper are posted around the classroom each with a question. (Please: depending on your physical space, it may be necessary to move to another room or possibly into the hallway. Teachers should have prepared the chart papers prior to class).

The questions include:

- *What did the mural and the lessons leading up to it teach you about art?*
- *What is one takeaway you have about the social issue of minimum wage?*
- *Would you advocate or oppose an increase to the minimum wage?*
- *How do you think mathematics and social justice are connected?*

- *What goals do you have for yourself as an activist moving forward?*
- *What was the most challenging thing for you about these lessons or activities?*
- *Identify a possible future social justice endeavor you would like to explore.*

Note: The segment includes times for whole group discussion and sharing of student's responses. Bring students together and look over the posters they have created. Note any particular commonalities or repeated messages.

You will want the conversation to develop organically as preparation for the Socratic seminar which will take place in Lesson 5. Provide guidance as needed. For those students who may be reluctant to share consider sentence stems such as:

- *I mentioned that...Can you add on?*
- *Is that what you believe or do you evidence that suggests something different...*
- *Is it your position also that...*

Allow students time to circulate and write their individual answers to each question. This should be a quiet activity, though students are welcome to read their classmates' work.

### **Assessment**

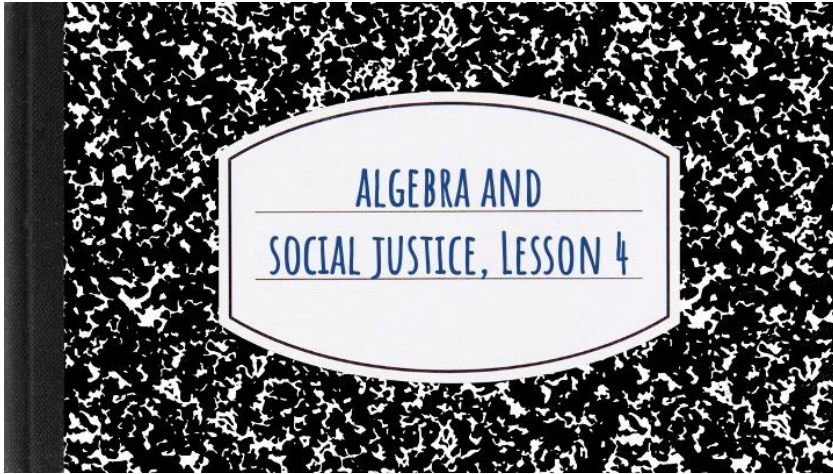
**Prompt: Ask each student to articulate one way they hope to bring art and activism into their lives at school, at home, or in their communities. Go around the circle and allow each student to share his or her goal.**

Collect feedback from students, including reflections of the overall project. The teacher should walk around and listen to student's conversations during the gallery walk to collect antidotal notes.

The purpose of the assignment is to prepare for the fish-bowl Socratic seminar that will help students synthesize their work completed within the unit. The Socratic seminar will take place in during the culminating lesson, Lesson 5.

\*\*If time permits, students can make any revisions to their final product. Students will present their product as part of the Socratic Seminar. Allow time for students to seek feedback from you, the instructor. Lesson 5 is show time!

PowerPoint Presentation, Lesson Four



DO NOW:

What does "activism" mean to you now?

An illustration of two hands holding a red sign. The hands are orange and yellow, with fingers spread as if holding the sign. The sign is red with white text that reads "ACTIVISM AND SOCIAL JUSTICE" in a bold, sans-serif font. The background of the illustration is a light blue gradient.

TODAY'S AGENDA

*Students will reflect over what you have learned and accomplished while thinking about the relationship between mathematics and social justice/activism.*

*Students responses will be shared in a Gallery Walk.*

## TODAY'S OBJECTIVES:

Students will be able to

- synthesize the knowledge gained over the unit of the lessons, including honest reflection on the challenges in relating mathematics and art to activism
- reflect on how our thinking about activism has changed or evolved.
- set goals for carrying these lessons with us in future endeavors.

## KEY VOCABULARY

- **activism** -a series of actions undertaken by people with the aim of creating change
- **reflect** -to think carefully about something

Take time  
to reflect





## Appendix E

**Unit:** The Bare Minimum about Minimum Wage, Lesson 5

**Subject:** Algebra One

**Grade:** Eight/ Ninth Grade

**Time Limit:** 90-minutes

### **Common Core Standards**

- **W.9-10.1** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
- **W.9-10.1a** Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
- **L.9-10.1** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

### **Mathematical Practices**

16. Make sense of problems and persevere in solving them.
17. Construct viable arguments and critique the reasoning of others.
18. Model with mathematics.
19. Use appropriate tools strategically.
20. Attend to precision.

### **Objectives:** Students will be able to

- synthesize the knowledge gained over the unit of the lessons, including honest reflection on the challenges in relating mathematics and art to activism.
- reflect on how our thinking about activism has changed or evolved.
- set goals for carrying these lessons with us in future endeavors.

### **Materials Needed**

- None

### **Introduction:** (5 minutes)

Students have completed reflection pieces throughout the unit. Students have completed the gallery walk and participated in whole group discussions and have had the

opportunity to construct an argument, either for or against, the increase of minimum wage. Students will now participate in a Socratic Seminar to share their ideas and thoughts.

I chose to implement a Socratic seminar because it is a “formal discussion” that allows students to listen carefully to the comments of others, thinking critically for themselves, and articulate their thoughts and their responses to the views of others.

Use this time to have students arrange the seating and collect their final product.

**Instructional Sequence:** (80 minutes)

Socratic Seminar- Ask half of the students to sit in an inner circle. These students will participate in the conversation, while the other half sits in the outer circle and observed an assigned student. The students in the outer circle will be required to complete the Peer Feedback Form based upon their specific student.

The immediate goal is to have students hear from their peers but also experience being heard themselves.

After thirty minutes, the circles switch.

Closure:

Congratulate students on the participation in the unit. Add any antidotal notes observations about how you personally have observed students evolve.

Provide students at least five minutes to complete the feedback form. Students should share their forms with their assigned partner.

**Assessment**

Each student will be required to provide feedback to their peers on their presentations. At the beginning of the class, students were randomly and anonymously assigned another student to critique during the seminar. Their feedback form will serve as an exit ticket.

I choose this form of assessment because I think it essential that as students endeavor to participate in future acts of social justice and activism, they know who their peers perceive them. It is my hope the feedback shared will encourage students to share their voice in an effective and skilled manner.

Each student’s final product will be assessed for accuracy, connections to mathematics, and a clearly articulated social justice position.

## Appendix F

# Minimum Wage

---

By Shahin Shabanian

Minimum Wage deserves a rage;  
The Market has placed us in a cage.  
We should muster our courage:  
A Living Wage is needed for this age  
And our solidarity is on the same page.

Minimum Wage doesn't pay the rent  
But we are told to relent:  
Eat grass, drink rain, live in a tent,  
Work hard and be content.

While corporate masters drink champagne,  
Contemplate mischief, celebrate their reign,  
They are deaf to workers' cries, whose children get one meal,  
They pay no Living Wage; from workers they steal.  
They claim the Market decides workers' worth,  
And their million dollar bonuses with mirth!

But the Market is a lawless entity,  
Yet, in charge of nations' economic security!  
It is manipulated by the same corporate nobility;  
Without any due public accountability.

It's been proven again and again:  
Corporations cheat and pay no taxes on gain  
And they drive the system insane.  
Corporations move on whims;  
Laws are null or on freeze.  
Corporations follow no rules;  
The public is lied to and made fools.

Corporations buy politicians cheap;  
They put the public in crisis deep.  
Corporations write our laws to control;  
Then, politicians are played like trolls.  
These laws favor the rich,  
By keeping Labor in a ditch.

A sage has said it well, "This game is rigged."  
In absence of equity, our pockets are picked.  
Workers are milked for capital to retain  
Prosperity for rich, austerity for poor and workers in chains.

## Activity

Visit the <https://www.thebalancecareers.com/2018-19-federal-state-minimum-wage-rates-2061043>

1. What is the national minimum wage? When was the last time the wage was increased?
2. Do all the states have the same minimum wage? Why do you think this exists?
3. Will Tennessee increase the minimum wage in 2020?

You, and most of your peers, are going to look for employment soon. What are your thoughts about the minimum wage?

Some companies have decided to set a minimum wage for their employees that is at a higher level than the federal and state rates. Look at the list of companies. Would you consider working for these companies?

Read the poem, “Minimum Wage”, and answer the questions.

4. Why do you think the author feels this social justice issue, minimum wage, “deserves a rage” and why must we display courage?
5. Shabonian uses the term “living wage.” Who is this different, or similar, to the minimum wage?
6. Shabonian also uses the term “Market”. What is this a reference to and why do you think she describes it as a “lawless entity”?
7. What does the author mean by “This game is rigged.”
8. Shabonian suggests there is an “absence of equity.” Do you agree or disagree and be prepared to support your claim.?
9. Explain the author’s last line of the poem, “Prosperity for rich, austerity for poor and workers in chains.”

## Appendix G

### Social Justice Feedback Form

Your name: \_\_\_\_\_

Presenter: \_\_\_\_\_

Regarding the presentation overall, to what degree do you agree with the following statements:

1= strongly disagree   2= somewhat disagree   3= no response   4= somewhat agree  
5= strongly agree

1. Throughout the presentation ideas flowed in a logical comprehensible manner. \_\_\_\_\_
2. I was able to understand the ideas that were presented. \_\_\_\_\_
3. The final product (or explanation of) addressed the intersection of social justice and mathematics. \_\_\_\_\_

To give the presenter a better sense of your experience, please respond to the following questions:

1. What is one thing you learned from their presentation?
  
  
  
  
  
  
  
  
  
  
2. What is one thing the presenter did well?
  
  
  
  
  
  
  
  
  
  
3. What is one suggestion to help improve future presentations?
  
  
  
  
  
  
  
  
  
  
4. Is there anything else you would like the presenter to know?

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