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RESEARCH ARTICLE

Mathematics curriculum as a vehicle for democracy and social justice

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Abstract
Mathematics has for too long been considered a neutral subject and the teaching of mathematics apolitical. Yet, mathematics is a powerful tool for understanding social life and the inequities therein. Further, the valued language of mathematics can be used for advocacy towards a more socially just society. Mathematics curriculum, therefore, has the potential to strengthen our democracy and propel society towards social justice. The application of mathematical content to social issues can inspire students as they connect mathematics to their world. This connection can help us move beyond the teaching of skills and concepts and towards actively engaging students in the work of democracy itself. In this paper I explore the ways in which mathematics curriculum can be used as a vehicle for democracy and social justice. I propose that mathematics can be used to engage in critical debate about the issues that affect society and to advocate for change actively and emphatically. Examples of how mathematical content can contribute towards these aims will be included. There has been fierce resistance recently to embedding social issues in mathematics curriculum and this resistance will also be addressed.

Keywords Mathematics education · Democracy · Math for social justice · Mathematical literacy

Mathematics teaching as a political act

For far too long mathematics has been seen as a neutral discipline and its teaching as apolitical. Taught as a series of facts and procedures/algorithms that are detached from the daily lives and experiences of the students who are learning it, mathematics has traditionally been seen as objective and, by extension, apolitical. While many in our society buy into this belief, it is in fact not true. The work of educator and activist Paolo Freire (1994) posits that all teaching is political in nature. Further, he warns that any effort to convince individuals otherwise should be considered an attempt to "soften any possible rebelliousness in the part of those to whom injustice is being done" (Freire, 1994, p. 78). Despite the work of Freire, viewing the teaching of mathematics as political in nature is a more recent development.

> Until recently, embedding mathematics pedagogy within social and political contexts was not a serious consideration in mathematics education. The 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? 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 (Tate, 2005, p. 37).

The teaching of mathematics is political in several ways. One of these has to do with access. That is, who does and does not have access to rigorous upper-level mathematics courses taught by experienced teachers in well-resourced schools? The National Science Foundation defines those groups that are under-represented in mathematics as those whose representation in mathematics programs and careers is less than their representation in our society (National Science Foundation, National Center for Science and Engineering Statistics, 2021). Among these are women, Blacks, LatinX, individuals and those from Indigenous populations. It has been shown that individuals in these groups are less likely than their more mainstream peers to have access to upper-level mathematics courses such as advanced placement courses for which they can earn college credit. As an example, according to data compiled by the U.S. Department of Education Office for Civil Rights (2018), while 50% of high schools offer calculus courses, the percentage drops to 38% when considering schools with high Black and Latinx

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enrollment. Individuals in under-represented groups are also less likely to have experienced teachers, and less likely to be in schools that are well-funded/well-resourced. As an example, teacher turnover rates are 50% higher for teachers in schools serving students from lower-income families and 70% higher for teachers in schools serving the largest concentrations of students of color (Carver-Thomas & Darling-Hammond, 2017).

Additionally, Card and Giuliano (2016) studied a policy change in one large urban district having to do with placement of students into the gifted and talented program. Initially, students were referred often by teachers to take an exam that would allow them entry into the gifted and talented program. Students in that program were provided a more rigorous instruction in mathematics as well as other disciplines. Further, the average class size in the program is smaller than that in the general education program. The program had a disproportionally high number of white students in it. At one point the district made the decision to test all students rather than testing only those that had been referred to the program. Under this new universal screening model, the number of Black and LatinX students increased dramatically. As Card and Giuliano note, the criteria for acceptance into the program remained the same. What changed was the access that students from traditionally marginalized communities had to testing and as a result the access that was now afforded them to rigorous mathematics instruction. Sadly, the program was deemed too costly and even though it led to a more equitable placement of students it was abandoned. These decisions affect very directly access to high quality mathematics instruction of the type that is needed for students to successfully navigate the educational system.

Students from marginalized communities are more likely to be in a school that offers remedial mathematics courses rather than enrichment courses which has implications for their future and contributes to these students being pushed out of mathematics. As an example, 38% of high schools that serve predominantly Black and LatinX students offer calculus courses, while the number of high schools overall that offer such courses is 50% according to data compiled by the U.S. Department of Education Office for Civil Rights. Further schools that serve students from marginalized communities tend to suffer from overcrowding as evidenced by the fact that over 2/3 of fourth and eighth graders who took the National Assessment of Educational Progress (NAEP) exams in 2019 did so in overcrowded classrooms with most of these schools in the poorest areas (Cai, 2021).

As we have seen, issues of access and policies that favor some students over others are political considerations. I have focused here on populations defined as under-represented in mathematics by the National Science Foundation as these are often the subject of my research and yet similar arguments can be made for other groups. Individuals with certain disabilities might also lack access to higher level rigorous instruction in mathematics. As an example, students with print disabilities may have difficulty accessing visual information such as graphs that cannot be easily described through screen readers or braille. Further, students who live in poor communities or in geographic regions that are hard to access due to existing transportation and infrastructure might also be denied access valuable educational experiences in mathematics.

School funding, access to experienced teachers, and the level of resources available to schools are also political considerations and have a huge impact on the teaching and learning of mathematics. Access, however, is just one of the ways that the teaching of mathematics is political in nature. A second reason has to do with what is taught and who is credited with those ideas. In her book, *Inventing the Mathematician: Gender, Race and Our Cultural Understanding of Mathematics*, Sara Hottinger (2016) explores characterizations of mathematicians in texts about the history of mathematics. Here she notes that even though there have been mathematical contributions from numerous civilizations and peoples, most history of mathematics texts focus on the contributions of European men above all others.

As an example, we consider numeration systems. A numeration system consists of numerals and rules for working with them which are used to write numbers. Every civilization of which we know has had a numeration system. This can be as rudimentary as 1, 2, some, many or as complex as the base ten system that we use today (Burton, 2010). However, until recently the only numeration system, outside of our own, that was taught in schools was the Roman numeration system. Though every single civilization has had a numeration system, our curriculum in mathematics clearly favored, and in many ways still does, a history of the subject that highlights the contributions of Europeans over all others. It is part of what Stinson (2013) has called the *white male myth*, which protects the idea that mathematics is the product of Western, white rational thought alone. It is for this reason that the numeration system of the Romans was prioritized and included, while that of the Egyptians, Babylonians, Mayans, and others was excluded. Attempts must be made to intentionally include the contributions of non-European mathematicians and civilizations if we are to counter the belief that mathematics was developed primarily in Europe.

Another example has to do with the Pythagorean Theorem which states that the squares of the lengths of the legs of a right triangle sum to the square of the length of the hypotenuse (the longest side). This theorem succinctly expresses the relationship between the lengths of the sides of right triangles. Surely it was known to the Egyptians who built the pyramids. If you find yourself at the center of the square base of a pyramid and look above you, you will see the point

where the triangular faces of the pyramid meet. Drawing an imaginary line straight down from this point through the length of your body and then out your feet to the wall before you, yields a right angle. The Egyptians did not construct the pyramids by trial and error. The existence of these right angles within the structure of the pyramids is evidence that they had knowledge of the theorem, yet it is Pythagoras, centuries later, who gets the credit for it. It is known also that the Babylonians were aware of the relationship between the lengths of the sides of right triangles as Babylonian clay tablets with tables of measurements that adhere to the relationship expressed in the theorem exist. The numbers on these tablets are large enough that it is believed they could not have been determined without knowledge of the relationship. In fact, the Babylonians had a method for generating Pythagorean triples (sets of three counting numbers that fulfill the Pythagorean Theorem) since 1800 B.C.E. but the formulas used are generally attributed to the Greek mathematician Euclid centuries later (Burton, 2010).

That much of the mathematics we teach is attributed to European mathematicians obscures the contributions of non-Europeans and paints a picture of the discipline as the epitome of Western thought when, in fact, there are numerous contributions to the development of mathematics by non-Europeans (Hottinger, 2016). These contributions, however, are routinely left out of the curriculum as well as public discourse around the discipline and its history. It is almost impossible for an average person to name three women mathematicians or three non-European mathematicians, as an example. What mathematics is taught and who is credited with those ideas are political considerations. It is encouraging that students in the K-12 system presently are being exposed to various numeration systems (not just that of the Romans) but there is still much work to be done to make explicit the contributions of non-Europeans and those from marginalized communities to the discipline. One place one might look to for more information is the text, The Crest of the Peacock: The non-European Roots of Mathematics (Joseph, 2010).

A third way that mathematics can be seen as political is in how it is used. Mathematics is often used as a gatekeeper to further education and careers. In order that one my graduate from high school, a mathematics exam must be passed. To enter college, one needs to take an exam that includes mathematics and once in college, regardless of one's major, one needs to take and pass a mathematics course. Often to obtain a civil service job, a mathematics exam is required. When it comes to traditional measures of success in our society, it is often the case that mathematics plays a part. Therefore, mathematics, usually algebra, is often used as a tool for perpetuating the social inequities that exist in our society. Moses and Cobb (2001) saw the role that algebra plays as a gatekeeper to future success and likened the importance of access to high-quality mathematics instruction in algebra to Blacks earning the right to vote. Douglas and Attewell (2017) studied the role of mathematics as gatekeeper by using data from the Educational Longitudinal study of 2002 which concluded in 2012. The researchers found that high school mathematics – as measured by test scores and/or coursework completed – was associated with various higher education milestones including attending a four-year college and completing a bachelor's degree. This was true even when controlling for other variables such as family background and general academic performance. Taking calculus in high school was associated with a 16-percentage point increase in the probability of attending a four-year college as compared to students whose highest mathematics class in high school was algebra 2. I often joke that if dancing were held in the same regard, I would not have the position I do today. Of course, it is not dancing but mathematics that is held in this position of power and so many have their futures impacted by their ability in this area, most specifically as it relates to numbers and algebra.

It is possible, however, to use mathematics in a way that is much different than we presently do and in doing so deprive it of its gatekeeper role. In addition to lessening the importance given to algebra as a gatekeeper to future success, we can use mathematics as a powerful tool to understand social life (Gonzalez, 2023; Gutstein, 2012; Gutstein & Peterson, 2005). That is, we can use mathematics to understand the world around us including the inequities that exist within it. Mathematics, when used in this way can serve to empower students as they analyze, interpret, and advocate around social realities using mathematics as a tool for social change. In this way mathematics becomes a tool for democratic participation in society and ultimately for social justice.

Imagine you are considering the issue of housing discrimination. Policies such as redlining have impacted who among us does and does not own a home. Redlining is a discriminatory practice where services such as mortgages and insurance loans were systematically denied, and predatory loans were offered to individuals living in certain areas deemed financially weak based on race or ethnicity. Redlining, coupled with the effects of slavery and racism have made considerable impact with respect to home ownership and as a result the distribution of wealth in the United States. You can use mathematics to explore homeownership rates over time for people of different races or people with different levels of educational attainment. You can represent the issue using graphs, tables, and charts. You can use existing data around homeownership to predict how rates will change in the next ten years. You can propose interventions aimed at making homeownership more equitable across races or levels of educational attainment. For example, one may propose voucher programs to assist families in purchasing a home and explore the impact of said vouchers on different

communities over time. In this way mathematics (percentages, ratios, regression, data analysis, visual representations of data, etc.) can be used to explore a social issue and to propose ways to make that issue more equitable. When used this way mathematics becomes less about gatekeeping and more about creating a social world that is more equitable than the one that currently exists. Yet for mathematics to be used by students in this way, our curriculum must change so as to value the use of mathematics as a critical tool for understating our social world and advocating for changes that lead to its betterment.

The ability to use mathematics as a tool for understanding and improving our social world also affords us the opportunity to fully participate in this society. That is, that without the ability to logically understand our social world and the vast statistical and mathematical models used to describe it, we are unable to be informed, aware, and able to think critically about the issues confronting our society. This puts us as a disadvantage with respect to participating fully in a democracy. I stop now to consider the role of individuals in a democracy. It seems at this point that the idea of a citizen bears some attention.

Citizenship as desirable activity

Before delving into the connections between knowledge of mathematics and one's role as a citizen in a democratic state, let us consider the construct of citizen. Kymlicka and Norman (1994) warn that there are two different concepts often conflated in discussions about citizenship. These are "citizenship-as-legal-status" and "citizenship-as-desirable-activity" (p. 353). We focus the discussion here on the second of these, noting that there is quite a lot of variety in how citizenship of this type has been defined over time and across different types of societies (Irving, 2016). As an example, Westheimer and Kahne (2004a & 2004b) describe three types of citizens: the personably responsible citizen, the participatory citizen, and the social-justice oriented citizen. While the roles of a member of society may be limited to those with certain legal status (ie. the right to vote, the right to serve on a jury, etc.), the discussion here is not. Instead, citizenship is defined broadly to include all members of a given society. This allows us to consider all members of the democratic society who have the potential to contribute to the social and political life of that society in some way whether they be legal citizens or not. It also allows us to consider the construct of citizen as desirable activity.

What, then, is the *desirable activity* that *citizens* should engage in? There is no consensus as to what constitutes a *good citizen* (Stuteville & Johnson, 2016; Westheimer & Kahne, 2004a & 2004b). Therefore, I rely on the work of Eudaily (2005) who argues that good citizens are competent, responsible and engaged members of society and further, that these characteristics can be measured across four areas: (1) an informed and thoughtful awareness of community issues, (2) participation in efforts to address social, cultural and political realities within their communities, (3) the undertaking of political acts such as group problem solving, voting, protesting and petitioning, and (4) moral and civic virtues.

Let's stop now to reconsider what makes for a *good citizen* in a democratic state. Here we may develop as a start, the construct of a critical participant. That is, one who is aware of the inherent power relationships working within society and actively works to expose and challenge these. Further, a society, founded on the principal of member participation, on government of, for, and by the people requires citizens who actively participate in the social and political life of their society for its betterment. They are informed/aware, engaged, and active. While not sufficient, I believe that mathematical literacy is a necessary condition for critical participation in one's social world. In fact, one can argue that to fully participate in a democratic state one needs a certain level of comfort with numerical and quantitative measures. We call this comfort mathematical literacy.

Mathematical literacy

To fully participate in a democratic state in ways that align with the view of citizenship as critical participation requires a special literacy, called mathematical literacy, that involves knowing how to question information that is presented, how to evaluate the accuracy of an argument, and how to critically examine the data used to support said argument (Goodlad et al., 2004). Additionally, it requires one to be able to take on differing perspectives and to view issues from the vantage point of different stake holders. Knowing what questions to ask, how to ask them, and evaluating arguments involves to the ability to think critically with numbers and other mathematical constructs. While extensive research has been done looking at what specific level of literacy is required to be an informed voter, similar research into the necessary level of mathematical literacy required is lacking. Yet, the interconnectedness between a functional understanding of logical reasoning skills, numerical fluency, statistical numeracy, and the ability to effectively carry out one's civic duty is undeniable. As a result, issues of mathemacy, mathematical literacy, numeracy skills, and quantitative literacy (which I use here interchangeably though some scholars do not) are receiving increasing attention.

Just as literacy is more than the ability to read and write, the idea of mathemacy can be developed to mean more than just the ability to calculate. Skills such as the ability to

question numerically driven arguments and to reason logically enable one to be a critical participant as previously defined. This is especially so, given that "virtually every major public issue – from health care to social security, from international economics to welfare reform – depends on data, projections, inferences, and the kind of systematic thinking that is at the heart of quantitative literacy" (Steen, 2001, p. 10).

> If individuals lack the ability to think numerically they cannot participate fully in civic life, thereby bringing in question the very basis of government of, by and for the people...[the consequences of innumeracy can be] profoundly disabling in every sphere of human endeavor – whether it be in the home and private life, work and career, or public and professional pursuits. (Orrill, 2001, p. xvi)

The word *democracy* means rule by the people, a reality that is not possible without an informed, engaged, and mathematically literate citizenry.

Teaching mathematics to support citizenship

First, I remind the reader that we are using the word citizenship broadly to mean any member of a society and not using a legal definition of citizenship. Given this broad definition of citizenship, we can consider that members of a society might be called to undertake a number of roles. They may be called upon to vote and/or take leadership roles at parent-teacher associations, housing (coop/condo) boards, unions, business-related committees/boards, and community organizations among others. They may vote on union contracts or association bylaws. They may need to decide how resources are allocated at their work, in community organizations of which they are a part or in their personal life. In these endeavors mathematical knowledge is also necessary to make informed decisions that benefit the individual and the community of which they are a part. What does this all mean for us as educators? At a minimum, it means that we must reflect upon the ways we teach mathematics to support citizenship.

Teaching mathematics to support citizenship means including explicit examples of the ways in which mathematical concepts intersect with our roles as citizens. This means going beyond the questions in the back of the book and finding real-world examples of how mathematical knowledge is useful to critically understanding our social world at this time. It means bringing the social and political debates of the day into our classrooms and examining them through mathematics. When teaching probability, we can move away from marbles in jars and examine instead situations that are real, meaningful, and relevant to students. Turner and Font Strawhun (2005) share a lesson where students examined percent change by examining the racial and gendered make-up of the house and senate in the United States across time. In this way the mathematics learned connected explicitly to the students' realities and to their awareness of the role of diversity in government representation.

Consider that if we model mathematically how changes in the tax law, the minimum wage, the cost of a trip on public transportation, the district lines that are used to determine school zones affect various groups of people and define those groups in multiple ways (using race, gender, age, economic status, employment status, home owners, families of different sizes, etc.) we are highlighting to students, many of whom view mathematics as removed from them, the way mathematics intersects with our world in a myriad of ways. We also arm them with the ability to identify mathematical arguments, critique them, and build their own. The mathematics taught does not change when we address these questions. What changes is how the mathematics is used, how we connect the content to the world/realities that our students face, and how we treat mathematics not as a collection of facts but as a powerful tool.

Mathematical literacy and civic duty: two examples

Let us consider two examples that highlight the role that mathematical literacy plays in carrying out one's civic duty. Specifically, let us consider one's role as a juror and a voter.

Mathematics and the grand jury

Recently, I had the opportunity to serve on a grand jury where, my peers and I heard testimony from witnesses and decided if sufficient evidence existed to indict the individual in question and move forward with a trial. Serving was at times interesting, at times dull, at times frustrating and at times quite rewarding. While I might have expected such contrasts, what I did not expect to find was an example of how mathematical knowledge is essential to carrying out one's duty as a grand juror and it is this realization that initially drove the development of this paper.

The 5th amendment of the constitution of the United States begins, "No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury" noting exceptions for times of war and public danger (U.S. Const. amend. V n.d.). A grand jury decides if there is enough evidence to charge a person with a crime.

Among the cases my fellow jurors and I deliberated was one in which the charges included both "criminal possession of a weapon in the second degree" and "criminal possession of a weapon in the third degree." In order to indict for the crime of criminal possession of a weapon in the 3rd degree, a particular condition, call it *A*, must be met. In order to indict for criminal possession of a weapon in the 2nd degree condition *A* must be met and additionally condition *B* (having been previously convicted of a crime) must also be met.

We are dealing with two statements (*A* and *B*) each of which can be can be true or false. Better said, each juror who votes is doing so with the belief that each of these statements is either true or false. To indict for the lesser charge, a juror believes that the statement *A* is true. To indict for the greater charge, that same juror believes that the conjunction *A and B* is true. Mathematically, if the statement *A and B* is true, then the statement *A* is true and the statement *B* is also true.

It is sometimes the case that the charges upon which the jury must vote are not all presented at once. In fact, the jury may hear both the evidence in the case and the charges over a series of days or weeks. In this case we were first asked to vote as to the greater charge. After deliberation there were enough votes to indict on the greater charge. That is, there were sufficient jurors who believed the statement *A and B* to be true. When the assistant district attorney returned later that day asking us to vote on the lesser charge, I thought that was as good as done. After all, the conjunction *A and B* is true if and only if each statement *A* and *B* is true on its own. Voting in favor of the greater charge means that you believe statement *A* is true and that you believe statement *B* is true. When the ADA returned, he was asking us if *A* was true, surely the people that voted to indict previously (lest they had a change of heart) should vote in favor of the lesser charge as well. It might be that there were more jurors voting to indict on the lesser charge but mathematically there should be no fewer.

The ADA and court reporter left the room and at once the jury began to deliberate. I could not understand why we were rehashing this argument when we already indicted on the greater charge. A vote now for the lesser charge should lead to an indictment as well. I attempted to explain the mathematical logic behind the decision we were being asked to make. A few of my fellow jurors grinned in my direction but most continued to argue the merits of the case. One, an engineer by trade, told me to "give it up" and whispered to me that he wasn't sure most people followed what I had said. When we did vote there were fewer votes in favor of an indictment than there had been to indict on the greater charge. I couldn't shake the frustration I felt. As I left the courthouse that day, I considered whether there could be any seriously negative repercussions to this lack of knowledge of basic logic in terms of the legal process.

At its worse, what could have happened is that while the jury had voted to indict on the greater charge (criminal possession in the second degree), they could have voted against the lesser charge (criminal possession in the third degree). The case would have gone to trial. Perhaps the prosecution would have had enough evidence to convict on the lesser charge, but the defendant was being charged with the higher charge. Playing out the worst-case scenario, the prosecution may not have had enough to prove their case as to the higher charge. As the grand jury voted, illogically, not to indict on the lesser charge, the defendant would have gone free when perhaps he/she had been guilty of the lesser charge.

Mathematics and voting

Propositions/referendums

Sharing my experience on the grand jury with a colleague led me to learn of similar instances involving mathematical logic and carrying out one's civic duty. In 2012 voters in North Carolina were asked to vote on a law that would change the state constitution to ban not only same-sex marriage, which was already the case, but to ban any civil union for same-sex couples. The law was written using a double negation. Rather than ask if one supports statement *A*, voters are asked if they oppose not supporting *A*. Couched in such language widespread misunderstanding of the law resulted in "only 40 percent of voters in the state" having interpreted the law correctly (Reader, 2012, p. 1). According to a survey by Public Policy Polling, as reported by Reader, 27% of voters thought the law would ban marriage alone (not other forms of civil unions), 26% of voters claimed to not understand the law and 7% believed that voting *yes* meant that they supported a law allowing, not barring, same-sex marriage. That is, 7% of voters voted completely contrary to what they intended. Further, polls conducted prior to the actual vote showed that 55% of would-be voters supported "some form of legal recognition for gay couples in the form of either gay marriage or civil unions" (Reader, 2012, p.1) and yet when the actual vote occurred 55% of voters voted to deny same-sex couples these same legal recognitions.

The confusion for voters around referendums written using a double negation is not new. Another striking example involves a vote in 1916 in Oregon. A federal amendment to the constitution had given black men the right to vote in 1865 and black women the right to vote in 1912. In Oregon black men and women had voted since these changes were made, and yet a law on the state constitution of Oregon, still banned blacks from voting. "…In the 1916 election attempts to repeal the restriction against the negro vote, which existed

only on paper, and give him the formal state right which he already had in reality failed" (Wembridge & Means, 1918). The vote seemed like a formality, a way to ensure that the constitution of the state mirrored both federal law and common practice in the state, yet the use of a double negation *to not prohibit* instead of *to allow* led to widespread confusion and a truly unexpected result.

Curriculum

Examples of lessons that use mathematics to highlight social issues and in doing so prepare students to be active members of a democratic state are becoming more plentiful as this approach to mathematics education gains popularity in what the educational researcher Gutiérrez (2013) has called a "socio-political turn" in mathematics. While no year-long curricular model exists at present, there are units and projects that have been developed. The text, Rethinking mathematics: teaching social justice by the numbers by Gutstein and Peterson (2005) includes many thoughtful lessons that deal with social justice issues. Additionally, there is a more recent collection of texts that address social justice issues at various levels of education through mathematics. These are *High school mathematics lessons to explore, understand, and respond to social injustice* (Berry et al., 2020), *Middle school mathematics lessons to explore, understand, and respond to social injustice* (Conway et al., 2022), *Upper elementary mathematics lessons to explore, understand, and respond to social injustice* (Bartell et al., 2022), *and Early elementary mathematics lessons to explore, understand, and respond to social injustice* (Koestler et al., 2022). A racial literacy curriculum for both grades K-8 and grades 9–12 is available through Pollyanna Inc., a New York based non-profit group at: https://pollyannainc.org/rlc-curriculum/ as well. The website https://www.radicalmath.org is another useful site as it provides both lessons and data sets. Though none of these are a comprehensive social justice curriculum in mathematics, work is underway to infuse social justice into mathematics in ways that support quantitative literacy and through that, citizenship (see Raygoza, 2019).

Classes aimed at Teaching Mathematics for Social Justice at the undergraduate level have begun to spring up on college campuses. These are typically aimed at students who are in non-STEM majors as well as those in teacher education programs and are a welcomed addition to more traditional college offerings (Hauk et al., 2022). Still, teaching mathematics to support democracy is in its infancy and much work in this area is still needed if we are to see it being used broadly and at all levels of education.

Resistance to this approach

While it is true that mathematics has undergone a "socio-political" turn as Gutiérrez (2013) writes and that the use of mathematics as a tool for understanding social life and advocating for a more just society is increasing, this has not come without fierce opposition. Some argue that infusing social justice issues in mathematics detracts from the mathematics and waters down the content (Lau, 2022). They have taken their concerns to politicians and school boards which have, in some states, enacted bans against the teaching of social justice in mathematics classes. One such ban exists in Florida (Levy, 2022) which has created sanctions against educators who do not abide by the ban. There are many who benefit directly or indirectly from the inequities that exist in society. Embracing the teaching of mathematics for democracy or social justice, involves a commitment to changing the current social order to one that is more equitable. Many of those who currently benefit from society as it is, are threatened by attempts to use mathematics to make changes that benefit others. Others are blind to the systemic racism that exists in this country and fully buy into the idea that we live in a meritocratic state. These individuals do not see a need for mathematics that challenges the current social order.

Mathematics as a tool for social justice and democratic participation is powerful and as such there are attempts being made to squelch that power. In Florida and Texas, for example, laws were passed making it a crime to teach mathematics in a way that addresses racism, social justice issues, gender and sexuality, and socio-emotional learning (Atterbury, 2022, May 5; Schwartz, 2021, May 17). The governors of these states have stated that teaching these topics is an attempt by educators to indoctrinate students and as such they must be excluded from the classroom. They have also banned numerous mathematics textbooks for addressing some or all of these areas. The teaching of mathematics, according to these state leaders, needs to be objective and apolitical. We have already touched upon the fact that mathematics and its teaching was never and will never be objective and apolitical. What we have not yet considered, which is worthy of mention, is that the textbooks and curricula that exist do value the experiences and histories of some students over others. Most textbooks and curricula prioritize a white, middle-class view. In his work Tate (2005) gives an example of a class working on a problem having to do with buying cards to ride the metro. Students can buy a pay as you go card where each trip costs a certain amount or a weekly card where one can travel an unlimited amount of times. The students in the class he was observing were told that their parent would use the card to get to and from work over the course of a week and asked to determine which option is the better deal. Many of the students were getting the problem

wrong but not because they were doing the mathematics wrong. The teacher expected the parent in the problem to go to and from work once each way for 5 days a week so based the answer on someone taking 10 trips a week. Students in the class, however, had parents that worked multiple jobs and thus used more than ten trips in a week. In other cases, metrocards were shared among members of the family adding to the number of trips they would be used for during the week. The problem was built with a white, middle class background at its center but the students in the class had experiences that were quite different.

Thus, identity is being attended to in the curriculum even in mathematics. However, it is the identity of those at the center of our social world that is benefitting. Some are against programs and curricula that value culturally responsive teaching. That is, they seek to ban teaching that affirms and builds upon the histories and experiences of students from diverse backgrounds. Mathematics, they argue, should be taught independent of student identities. We know however that the teaching of mathematics, the contexts used, the examples given, the problems asked are indeed centered on student experiences and histories. It is just that at present the students centered in the curriculum are those of the mainstream.

These new laws and book bans have put educators in these states in a tough spot as teaching mathematics in a way that is valuable to students and which supports their ability to grow into engaged and informed citizens could lead teachers to lose their job, be fined or even be incarcerated. It is a troubling reality but not one that is unexpected. When the current social order is threatened using powerful mathematics to highlight inequality and advocate for change, those who are currently benefitting from the inequities present in society may feel threatened and attempt to hold on to power in whatever way they can.

Beyond resistance and towards empowerment

If we are to actively challenge the resistance that has sprung up around the use of mathematics as a tool for the social justice, we must be engaged in numerous ways. We must advocate for changes to laws and policies that restrict the teaching of mathematics in ways that promote social justice. This may mean speaking out at school board meetings, writing to elected officials and getting involved in professional organizations that do this kind of work.

We must also take the time and care to infuse our mathematics classes with activities, discussions and lessons that support engaged citizens and advocacy towards a more socially just world. This will be challenging in many ways. Students are not used to mathematics being taught this way and neither are their parents, so there may be resistance from these as their conception of what counts as mathematics learning is challenged. Administrators may not be supportive of teaching in this way as these kinds of questions and activities are not prioritized on the standardized tests that drive school funding. It is, therefore, crucial to find the pockets of support that do exist and use these to support your teaching. Those who are more privileged in the educational system (tenured teachers with more experience, for example) need to step up so that their more vulnerable colleagues feel supported and protected when undertaking these changes in their own classrooms. I am not suggesting that those teachers in states where math for social justice is banned, implement this pedagogy in their classrooms as I understand the risks that exist, but those that are in more supportive situations should use their privilege to help push this pedagogy forward in the hopes that one day it will be more universally accepted and used.

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