MATHEMATICS FOR CITIZENSHIP

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Introduction

We humans seek to know ourselves and our relationship to the world around us. What kind of world do we live in? What kind of world would we like to live in? How can mathematics and social studies education scholarship together help us to consider, understand, and take purposeful action in alignment with our vision? This paper explores ways that instruction that builds on research in the areas of Quantitative Reasoning, Teaching Mathematics for Social Justice, and Citizenship Education can help learners, and future citizens enjoy more successful, collaborative, and satisfying lives.

Quantitative Reasoning

Reasoning with numbers has been a subject of human investigation for millennia, and philosophers (i.e. Condorcet, Dewey) have associated quantifying evidence about the state of society as an important component of civic responsibility for hundreds of years (Nicholson, Gal, and Ridgeway, 2018). Quantitative Reasoning (QR), however, has emerged as its own unique field of study focused on the application of numeracy to individuals' personal, professional, and social lives since the second half of the 20th century (Fisher, 2019). The bylaws of the Mathematical Association of America's Special Interest Group on Quantitative Literacy (QL/QR), for example, states 'QL can be described as the ability to adequately use elementary mathematical tools to interpret and manipulate quantitative data and ideas that arise in individuals' private, civic, and work lives' (Gillman, 2006).

Publications written about Quantitative Reasoning usually allude to the importance of a numerate citizenry within a healthy democracy. The seminal QR text, *Mathematics and Democracy: The Case for Quantitative Literacy* (Steen, 2001) states that quantitative literacy finds 'its most profound value to society [to be] the role it plays in supporting informed citizenship and democratic government' (Steen, 2001, p.10) and that 'it follows, however, that if individuals lack the ability to think numerically, they cannot participate fully in civic life, thereby bringing into question the very basis of government of, by, and for the people' (Orrill, 2001, p. xvi). Despite the emphasis on the relationship between numeracy and democracy in writings about QR, the connection between these areas has not been fully developed. As Erickson summarizes, 'given this valorization of quantitative literacy, we may well wonder what research has to tell us about the subject. Lacking, in all of this, is any theoretical articulation of the role it may play in civic participation' (2016, p. 5).

A new book from MAA Press (Tunstall, Karaali, Piercey, 2019), however, looks closely at QR scholarship and helps addresses this gap between numeracy and citizenship by providing theoretical and practical recommendations to tie these topics together. For example, one chapter used discourse analysis of scholarship associated with QR to highlight that most research studies emphasized individual empowerment goals for numeracy at the expense of developing how quantitative knowledge truly does relate to increased engagement with democracy. Craig, Guzman, and Harper summarized this finding when they wrote 'the attention of quantitative literacy scholarship has generally been on creating quantitatively literate individuals capable of protecting and helping themselves. These are important and worthy goals, but have arguably been the singular focus of quantitative literacy scholarship' (2019, p. 210). In order to more fully develop the relationship between individual empowerment through growth in quantitative literacy and how that can lead to increased participation in democracy, research from Teaching Mathematics for Social Justice and Citizenship Education are discussed in the subsequent sections of this paper.

Teaching Mathematics for Social Justice

Two mathematical organizations, the National Council of Supervisors of Mathematics and TODOS: Mathematics for ALL endorsed social justice as a key priority in the access to, engagement with, and advancement in mathematics education for the youth of the United States. In this announcement, they proclaimed that a social justice lens for teaching mathematics 'works to transform mathematics from a gatekeeper to a gateway, democratizing participation and maximizing education advancement that equitably benefits all children rather than a select few (NCSM, 2016).' An oft-cited goal of Teaching Mathematics for Social Justice (TMfSJ) is to support students in developing the capacity to 'read and write the world with mathematics' (Gutstein, 2006).

Reading the world with mathematics entails learners' valuing the subject of mathematics and being successful in the traditional sense (understanding, assessments, graduation, college, and/or career), as well as developing the capacity to see how mathematics can be a powerful tool for analyzing the world (Gutstein,2006). Writing the world with mathematics means using mathematics to change the world—and, in doing so, developing a sense of social agency and seeing oneself as capable of making change (Gutstein, 2003). Together, reading (reflection) and writing (action) the world constitute the dual processes of praxis. Gutstein's model of teaching mathematics for social justice (TMfSJ) relies on these dual processes and entails both mathematical and social justice-oriented goals, which are discussed below.

Reading the World with Mathematics

Gutstein (2006, p.29) argues that "reading the mathematical world is equivalent to developing mathematical power". Towards this end QR research has demonstrated that gains in mathematical literacy is associated with 'informed decision-making with respect to nutrition (Rothman et al. 2006), medicine (Fagerlin et al. 2007; Lipkus and Peters 2009), risk situations (Jasper et al. 2013), and financial matters (Allgood and Walstad 2013; Nye and Hillyard 2013; de Bassa Scheresberg 2013) … all of which can support one's attainment of objective goods like leading a healthy and prosperous life'

(Tunstall, 2017, p.9). By contrast, a limited understanding of mathematics can hinder life opportunities (Moses, 2002) and hinder a complete grasp of important social and political issues (Steen, 2001). 'Because innumeracy burdens individuals and numeracy empowers them, our work in quantitative literacy is fairly straightforward. We seek to move people from the former category into the latter, with the ultimate goal of making everyone quantitatively literate. Thus, a major goal for informed citizenship within quantitative literacy scholarship has focused on combating innumeracy with efforts for every citizen to be quantitatively literate' (Craig, Guzman, and Harper, 2019, p.209).

Through a TMfSJ lens, the aims of mathematics education should not be merely or primarily preparing students for a job. Instead it should be looked upon as something that prepares for the exercise of all the rights and the responsibilities associated with citizenship in a critical and conscious way. Freire (1992) called this developing sociopolitical consciousness or conscientização. Frankenstein (2006, p. 327) provides an example of transforming learners' consciousness to social and political matter of knowing mathematics through the example that "a mathematically illiterate populace can be convinced, for example, that social welfare programs are responsible for their declining standard of living, because they will not research the numbers to uncover that 'welfare' to the rich dwarfs any meager subsidies given to the poor". Citizens with this kind of ability to critically read the world with mathematics should start to question the ideologies below the surface of such contradictions. Hence, reading the world with mathematics according to Gutstein refers to deepening one's "understanding [of] the sociopolitical, cultural-historical conditions of one's life, community, society, and world" (Gutstein, 2006, p. 24 in Greenstein and Russo, 2019). This is the work of preparing for writing the world, which we will see is, by necessity, a socially collaborative process, not individual one.

Writing the World with Mathematics

If after using mathematics as a tool to read the world, one follows this by taking action aimed at improving the situation, then one has also 'written' the world with mathematics (Gutstein, 2006). Henry Giroux defines the concept of writing the world as: 'a critical mode of reasoning and behavior...[that] functions so as to help people analyze the world in which they live, to become aware of the constraints that prevent them from changing that world, and, finally, to help them *collectively* struggle to transform that world (1981, p. 114)'. This is not quickly or easily learned and has not historically been popular in schools.

Freire (Freire & Macedo, 1987) spoke of writing the world (and not just understanding it), which, for him, meant to remedy unjust situations. To write the world, students also need a sense of agency; that is, a belief in themselves as people who can make a difference in the world, as ones who are makers of history. Gutstein (2006) reflected that from his observations, learning to write the world with mathematics was as complicated, if not more so, than learning to read the world – because it entails taking action, or at least seeing oneself as making a difference through actions: this is a step further than just understanding a situation. A famous example of reading and writing the world with mathematics comes from William Tate's (1995) article about culturally relevant pedagogy. Students in this study read the world with mathematics by examining the proximity of liquor stores to their school using measurement and

numerical (percent, decimal, and fraction) calculations to understand and summarize their findings. However, students did not stop here with just understanding the mathematics; they went on to write the world with mathematics by presenting their mathematically-based arguments about this issue to the newspaper editor and the state senate. Table 1, below, provides a few examples of ways that students can mathematically 'read the world' and possible corresponding ways that they could go on to 'write the world' based on their results.

Reading the World	**Writing the World**
Measuring and summarizing the number of liquor stores within various distances from school	Presenting findings to newspapers and state senate and advocating for changes to legislation allowing/requiring distance between schools and liquor stores (Tate, 1995)
Exploring and summarizing data regarding incarceration and police violence data by race	Protesting police violence, 'stop-and-frisk', and arrest and sentencing policies and procedures. (Phillip and Rubel, 2019)
Exploring COVID data by a variety of demographic and legislative variables	Participating in community and social media campaigns to educate others about the impact of various COVID-related beliefs and practices.

Table 1. Examples of Reading and Writing the World with Mathematics

The step from reading the world to writing the world, however, is not quick or easy. Glover (2019) found in her dissertation study, which aimed to support students in obtaining mathematical power towards developing social agency, that participating students indicated that the lack of teacher guidance on how to take action added to their not being clear about how to "write the world" with mathematics. In general, QR scholarship and practice has not paid adequate attention to the responsibilities of those we would deem quantitatively literate. 'We have not often sought to understand how individuals interact together around quantitative issues and claims. We have also not attended to how people might use their quantitative literacy to help other people thrive in this world, instead focusing on how an individual should use their quantitative literacy to help themselves' (Craig, Guzman, and Harper, 2019, p. 210). These authors advocate for quantitative literacy scholarship to focus more on a *collectivist* perspective that tries to 'understand the potential roles of quantitatively literate groups and quantitatively literate individuals within groups' (Craig, Guzman, and Harper, 2019, p. 210). This focus necessarily broadens the focus of teaching math for real social justice beyond just quantitative methods and into the realm of the social sciences.

Phillip and Rubel (2019) share details of their TMfSJ work that (as have Bartell (2011), Frith et al. (2010), and others) with students and teachers where mathematics teachers alone were unable to carve out time, focus, and support to do justice to the complex systems that underlie data about social issues. They share that, upon reflection, their TMfSJ efforts 'demonstrate that teaching new quantitative literacies with the assumption that students will then better understand issues that are at the intersection of race and racism, personal agency, and the distribution of resources in society is naive at best, and perhaps more accurately, negligent and deleterious' (Phillip and Rubel, 2019, p.221). Instead, they recommend that classrooms strive to become 'laboratories

of democracy' where students can have opportunity and support to cultivate both the mathematical and civic skills necessary to be prepared to write the world with mathematics. The next sections highlights Citizenship Education research that can help us to more deeply understand goals and practices that can support the cultivation of laboratories of democracy.

Citizenship Education

A democratic polity needs active citizens who are willing and able to continue the ongoing vast experiment of building a just and responsive society that works for all of us. One of the most important functions of schooling is indeed to prepare students for participation in a vibrant democracy. Citizenship education, therefore, deals with the relationship between the individual and political society.

'Those pursuing the democratic purposes of schooling have long argued that educators should prepare youth to be informed about controversial issues, able to critically assess evidence and factual claims related to such issues, and able to judge and construct well-reasoned arguments' (Kahne & Bowyer, 2017, p.5). This helps create an informed citizenry—an essential component of a democratic society—by teaching students to weigh evidence, consider competing views, form an opinion, articulate that opinion, and respond to those who disagree. 'Varied opinions, vibrant discussions, contestation, and negotiation are valuable as they push individuals to justify their thoughts and actions' (Dewey, 1938 in Broom, 2015, p.81).

'The belief that accurate information will bolster democratic decision making and enable societal improvement is deeply embedded in the enlightenment paradigm, pragmatist beliefs, deliberative ideals, and other prominent conceptions of a strong, just, and productive democracy. The benefits of engagement with credible evidence stem from improving knowledge and understanding of issues, enabling assessment of varied viewpoints and policies, identification of one's interests in relation to varied policies, and supporting formulation of more effective responses to societal issues' (Delli, Carpini & Keeter, 1996; Dewey, 1927; Mill, 1859/1956 in Kahne & Bowyer, 2017, p.4). This conception of politics has its theoretical roots in the principles of deliberative democracy, a form of government in which free and equal citizens (and their representatives) justify decisions in a process in which they give one another reasons that are mutually acceptable and generally accessible, with the aim of reaching conclusions that are binding in the present on all citizens but open to challenge in the future (Gutmann and Thompson, 2004).

'Empowered individuals can consider varied perspectives, negotiate with others, amend policies as needed as they can think independently, make their own decisions thoughtfully and with reference to relevant information, and act on that knowledge. These behaviors make our democracy richer, deeper, messier, and more complex. The ability of individuals to actively engage with their worlds, to be empowered, is a civic right and a responsibility. It is the very essence of democracy. When carried out thoughtfully, it has a number of benefits for both individuals and their surrounding social environments' (Broom, 2015, p.81).

Since the turn of the new Millennium, scholars and politicians have been concerned about the apparent withdrawal of citizens from democratic participation. 'Citizens participate in public affairs less frequently, with less knowledge, and enthusiasm, in fewer venues, and less equitably than is healthy for a vibrant democratic polity' (Macedo, 2005, p.1). In particular, attention has often centered on young people, whose levels of electoral and party engagement tend to be lower than that of the population in general, and indeed of previous youth generations. Being an informed and engaged citizen (who is able to *write the world)* in the twenty-first century is more complicated than ever before, and the educational experiences we offer to students need to reflect this complicated world in which they operate.

Civic Engagement

Civic engagement refers to the many ways in which people participate in civic, community, and political life and by doing so express their engaged citizenship. From proactively becoming better informed, to participating in public dialogue on issues, from volunteering to voting, from community organizing to political advocacy, the defining characteristic of active civic engagement is the commitment to participate and contribute to the improvement of one's community, neighborhood, and nation.

Kennedy (2007) distinguishes three forms or levels of citizen activity in civic engagement. The first level is conventional political activity, such as engagement in voting. This is the minimum level at which those concerned with the democratic deficit would have us act. Although voting is indeed an activity, it is a minimalist action; however, it is nevertheless participation, and participation with a view to changing civic society. Informed engagement is clearly preferable to uninformed. The research is clear that voters make different choices and consider a wider range of perspectives when they are well informed. Many citizens are losing the hard news habit, however, or never develop a taste for quality information at all.

The second form of activity lies in social movements, in being minimally involved with voluntary activities – such as donating money on the behalf of social organizations. This form of participation is essentially conformist and ameliorative in nature: it is action to repair rather than to address causes, or even to acknowledge possible causes - an exhortation to discharge the responsibilities of neighborliness, voluntary action and charity.

The third form consists of action for social change, when the individual is involved in activities that aim to change political and social policies. This would range from such activities as letter writing and signing petitions to working with pressure groups, participating in demonstrations, and other ways of trying to influence decision making. At this level, local people are working together to improve their own quality of life and to provide conditions for others to enjoy the fruits of a more affluent society.

Action Civics

Good citizens are primarily understood to be individuals who actively participate in their nation's civic affairs, whether by engaging in more traditional practices such as voting or more activist means such as boycotting or protesting (Ross, 2012). An active

civil society requires citizens who have relevant knowledge and deep understanding, but also the skills for reflective and responsible action, willingness to engage, and deep commitment to democratic values. Experience with real-life civic action is important to cultivate civic identities that provide authentic and effective sources of motivation, purpose, responsibility, agency, and efficacy.

Action Civics is a specific model of citizenship education designed to create 'an engaged citizenry capable of effective participation in the political process, in their communities and in the larger society (Levinson, 2014a)'. Through this model, students do civics and behave as citizens by engaging in a cycle of research, action, and reflection about problems they care about personally while learning about deeper principles of effective civic and especially political action. An example of this Action Civics model is the 'Mikva Challenge's Issues to Action' program (Levinson, 2014a) that teaches students to 1) Examine their community, 2) Choose an Issue, 3) Research the Issue and Set a Goal, 4) Analyze Power, 5) Develop Strategies, and 6) Take Action to Affect Policy.

The Discussion section of this paper below ties together mathematics for social justice research and action with that of Citizenship Education to make recommendations for future integration of curriculum and instruction in these areas.

Discussion

There have been noteworthy examples of mathematics and statistics projects focused on supporting students in applying quantitative reasoning to social issues. Bartell (2011) documented her experiences working with teachers to teach mathematics for social justice and found that there was 'a tension in negotiating mathematical and social justice goals (p. 31)', 'teachers did not adequately contextualize the complex social, political, and historical issues related to their topic' (p.28) and that 'perhaps it is better not to do it at all than to engage with the issues in substandard ways' (p.31).

Phillip and Rubel (2019) similarly reflected that 'the assumption that students will better understand (systemic) issues that are at the intersection of race and racism, personal agency, and the distribution of resources in society is naïve at best, and perhaps more accurately, negligent, and deleterious' (p.218). Both Bartell and Phillip and Rubel concluded that if students are asked to critically engage in investigation of quantitative information about complex social issues that adequate time is necessary to tease out the myriad of factors, experiences, and perspectives related to the data. Hence, Phillip and Rubel's (2019) call for classrooms to operate as laboratories of democracy. They summarize that 'conventional approaches to new quantitative literacies will most likely lead to prioritizing one perspective over the other or at best an effort to address one goal while mitigating the impact on the other. Classrooms as laboratories of democracy could provide a space where differences in perspectives are examined out in the open to develop greater insight, stimulate constructive disagreement, and spark innovation (p.220)'.

ProCivicStat (2018) is an exciting multi-national project focused on promoting civic engagement via exploration of data and statistics about social issues. Their conceptual

framework (Nicholson, Gal, Ridgeway, 2018, p.7) highlights that ProCivicStat explorations should allow learners to:

- Recognize that there are "burning" social issues in one's society, e.g., regarding employment, wages, crime, pollution, economic opportunities and equality, access to services, and so forth
- Know that there is social *policy* about the issues
- Know that policy is shaped by politicians & decision-makers - and that decisions require choices and risks, weighing existing evidence, options and their probabilities, costs and benefits, expected values, and subjective utilities.
- Know that data, statistics, & evidence can inform social policy-setting, that there are levels of quality for "evidence"
- Know that citizens can influence policy-setting
- Feel empowered to engage social policy-setting

To date, this project has not disseminated findings from implementation with students, however, based on research from Quantitative Reasoning, Math for Social Justice, and Citizenship Education, the last bullet points may be easier said than done without meaningful time and support to develop these goals.

Projects such as this clearly follow recommendations that encourage students to take ownership of a civic challenge that they care about, support their acquisition of the knowledge and skills needed to take meaningful action, expect students to take that action. These kinds of experiences allow students to learn not just about citizenship, but to learn through citizenship. Then students can be challenged students to reflect upon the experience as a means of consolidating their learning and empowering them to take effective action in the future.

'Social transformation is clearly more complex than just learning to apply quantitative reasoning to civic and political problems. Conventional quantitative practices, which often gloss over the historical, social, political, and economic dimensions of power, will not be sufficient to ignite or facilitate authentic transformations' (Phillip and Rubel, 2019, p.216). 'Classrooms as laboratories of democracy aspire to allow students to adopt, adapt, transform, and judiciously select and reject quantitative or data literacies within the multiple, intersecting, and often conflicting intricacies of social existence. Deep social struggles are not problems that can be solved with the help of equations, data visualizations, or computational simulations alone; they are intricate problems that involve people as complex actors (Phillip and Rubel, 2019, p.220)'.

Craig, Guzman, and Harper (2019, p. 208) highlighted 'that the social practice commonly promoted by (traditional) quantitative literacy scholarship (has been) characterized by notions of self-reliance, self-interest, and self-preservation (*skills necessary for reading the world with mathematics*) while generally discounting ideas of social interdependence, collective good, and collective justice' (skills necessary to effectively write the world with mathematics) (*emphasis added).* These collaborative skills are not intrinsic and must be cultivated for true systemic change to occur. Civic Dialogue, in which people collaboratively explore matters of civic importance and consider the dimensions of a civic or social issue, policy, or decisions of consequence

to their lives, communities, and society are essential to deliberative democracy and must be practiced. 'In this context, dialogue is defined as two or more parties with differing viewpoints working toward common understanding in an open-ended, most often, face-to-face format. 'In dialogue, multiple and possibly conflicting perspectives *are* included rather than promoting a single point of view. Empathy and understanding *are* promoted. Assumptions are brought out into the open. Suspension of judgment is encouraged in order to foster understanding and break down obstacles. Equality among participants is established to honor all voices and help build trust and safety for deep dialogue' (Yankelovich, 1999).

Laboratories of democracy, therefore, are 'prefigurative spaces where participants embody the forms of social relations, decision-making, culture, and human experience that are the ultimate goal of an equitable and just democracy. Laboratories of democracy are places where people come together to experiment with ideas, share information, reflect, and self-correct. These spaces must entail a commitment to attend to internal and external forms of power with respect to the dynamics of group interaction and the content of inquiry. A focus on internal processes of deliberation emphasizes the importance of how we engage in democratic deliberation.' (Phillip and Rubel, 2019, p.217). It has been said that good citizens are made, not born. If we truly want to facilitate these habits and skills in our students, let's integrate what we know from mathematics and social studies education together and work towards this with intention, courage, and attention so we can to shape the kind of world that we want that considers social justice and good will.

References

Arthur, C. (2011). Financial Literacy Education for Citizens: what kind of responsibility, equality and engagement? *Citizenship, Social and Economics Education, 11(3).*

Association of American Colleges and Universities (1998). *Statement on Liberal Education*

Association of American Colleges and Universities (2014). *Quantitative Reasoning: The Next 'Across the Curriculum' Movement.*

Bartell, T. (2013). *Learning to Teach Mathematics for Social Justice: Negotiating Social Justice and Mathematical Goals.* Journal for Research in Mathematics Education, 44(1), p.129-163.

Blevins, B. and LeCompte, K. (2015). I Am Engaged: Action Civics in Four Steps. *Social Studies and the Young Learner*, 27(4), p. 23-26.

Branson, M. (2017). Fighting Alternative Facts: Teaching Quantitative Reasoning with Social Issues. *Problems, Resources, and Issues in Mathematics Undergraduate Studies, 29(3-4), p.228-243.*

Briggs, W. (2018). Quantitative Literacy and Civic Virtue. *Numeracy.* Volume 11 Issue 2 Article 7

Broom, C. (2015). *Empowering students: Pedagogy that benefits educators and learners.* Citizenship, Social, and Economics Education, 14(2), p. 79-86.

Center for Information and Research on Civic Learning and Engagement. (2020). *Youth Voting and Civic Engagement in America. Accessed at https://circle.tufts.edu/explore-our-data/youth-voting-and-civic-engagement-america*

Carretero, M., Haste, H., Bermudez, A. (2014). Civic Education in *Handbook of Educational Psychology, 3rd Edition*. London: Routledge

Craig, J., Guzman, L., and Harper, F. (2019). Quantitative Literacy Scholarship from Individualist, Collectivist, and Activist Perspectives. In *Shifting Contexts, Stable Core: Advancing Quantitative Literacy in Higher Education*. Tunstall, L., Karaali, G., and Piercey, V., Eds. MAA Press: Washington D.C.

D'Ambrosio, U. (1990). The Role of Mathematics Education in Building a Democratic and Just Society. *For the Learning of Mathematics.* 10(3), p.20-23.

Dewer, J., Larson, S., and Zachariah, T. (2019). Reflections on Sustaining QL Course Innovations: A Cautionary Tale. In *Shifting Contexts, Stable Core: Advancing Quantitative Literacy in Higher Education*. Tunstall, L., Karaali, G., and Piercey, V., Eds. MAA Press: Washington D.C

Dewey, J. (1931–32). *American Education Past and Future, The Later* Works, v6 Jo Ann Boydston (Editor), Southern Illinois University Press.

Dingman, S. and Madison, B. (2011). Twenty-First-Century Quantitative Education: Beyond Content. *Peer Review*

Erickson, Ander W. (2016). Rethinking the Numerate Citizen: Quantitative Literacy and Public Issues. *Numeracy, 9(2),* Article 4.

Fischer, F. (2019). What Do We Mean by Quantitative Literacy. In *Shifting Contexts, Stable Core: Advancing Quantitative Literacy in Higher Education*. Tunstall, L., Karaali, G., and Piercey, V., Eds. MAA Press: Washington D.C.

Friere, P. (1998). *Pedagogy of Freedom.* Rowman & Littelfield: Lanham, MD.

Friere, P. (1968). *Pedagogy of the Oppressed.* Verlag Herder: New York, NY.

Gillman, Rick. 2006. "Introduction." In *Current Practices in Quantitative Literacy*, MAA Notes #70, edited by Rick Gillman, vii-ix. Washington, DC: The Mathematical Association of America.

Gingold, J. (2013). *Building an Evidence-Based Practice of Action Civics.* The Center For Information & Research on Civic Learning and Engagement. www.civicyouth.org

Giroux, H. (1987). Liberal Arts, Public Philosophy, and the Politics of Civic Courage. *Curriculum Inquiry, 17*(3), 331-335. doi:10.2307/1179697

Glover, L. (2019) *Teaching Mathematics for Social Justice: How Students in an All-Girls Independent School Setting Use Mathematics to Read and Write the World*. Doctoral Thesis, Teachers College, Columbia University

Greenstein, S. and Russo, M. (2019). Teaching for Social Justice through Critical Mathematical Inquiry. In *Critical Mathematical Inquiry*. *Occasional Paper Series*, 2019 (41). Retrieved from https://educate.bankstreet.edu/occasional-paper-series/vol2019/iss41/11

Gutmann, A. and Thompson, D. (2004). *Why Deliberative Democracy?* Princeton, NJ: Princeton University Press.

Gutstein, E. (2006). *Reading and writing the world with mathematics: toward a pedagogy for social justice*. New York, NY: Routledge.

Hamman, K. (2019). Mathematics in Service to Democracy. In *Mathematics for Social Justice,* Karaali, G. and Khadjavi, L., Eds., p.19-22. MAA Press: Washington D.C.

Hess, D. and McAvoy, P. (2014). *The Political Classroom: Evidence and Ethics in Democratic Education.* New York: Routledge

Kahne, J., & Bowyer, B. (2017). Educating for Democracy in a Partisan Age: Confronting the Challenges of Motivated Reasoning and Misinformation. *American Educational Research Journal*, 54(1), 3–34.

Kennedy, K. J. (2007). Student Constructions of 'Active Citizenship': What does participation mean to students? *British Journal of Educational Studies,* 55**,** 304-324.

Levinson, M. (2014). Action Civics in the Classroom. *Social Education,* 78(2), p.68-70.

Levinson, M. (2014). Citizenship and Civic Education. In *Encyclopedia of Educational Theory and Philosophy*. Thousand Oaks, CA: Sage.

Macedo, S. (2005). *Democracy at Risk.* Washington D.C.: Brookings Institution Press

Madison, B. (2007). What Do We Mean by Quantitative Literacy? *For the Learning of Mathematics* 27(3)

Moses, B. and Cobb, C. (2002). *Radical Equations: Civil Rights from Mississippi to the Algebra Project*. Boston, MA: Beacon Press

Nicholson, J., Gal, I., & Ridgway, J. (2018). *Understanding Civic Statistics: A Conceptual Framework and its Educational Applications*. A product of the ProCivicStat Project. Retrieved 7/2020 from: http://IASE-web.org/ISLP/PCS

Noddings, N. (2005) *Educating Citizens for Global Awareness* New York: Teachers College Press.

Parker, W. (2011). Feel Free to Change Your Mind. *Democracy and Education*, 19(2).

Philip, T. and Rubel, L. (2019). Classrooms as Laboratories of Democracy: The Role of New Quantitative Literacies for Social Transformation. In *Shifting Contexts, Stable Core: Advancing Quantitative Literacy in Higher Education*.
Tunstall, L., Karaali, G., and Piercey, V., Eds. MAA Press: Washington D.C.

ProCivicStat Partners (2018). *Engaging Civic Statistics: A Call for Action and Recommendations*. A product of the ProCivicStat Project. Retrieved (7/2020) from: http://IASE- web.org/ISLP/PCS

Raygoza, M. C. (2019). Quantitative civic literacy. *Occasional Paper Series,* (41). https://educate.bankstreet.edu/occasional-paper-series/vol2019/iss41/3

Sanchez, M. and Blomhøj, M. (2013). The Role of Mathematics in Politics as an Issue for Mathematics Teaching. In *Critical Mathematics Education,* Ernest, P.,

Sriraman, B., and Ernest, N. Editors, p. 253-271. Information Age Publishing: Charlotte, NC

Sriraman, B. & Steinthordottir, O. (2009). Social Justice and Mathematics Education: Issues, Dilemmas, Excellence, and Equity. *Philosophy of Mathematics Education*, Volume 21.

Steen, L. (2001). *Mathematics for Democracy: The Case for Quantitative Reasoning*. Washington, DC: MAA

Steen, L. (2004). *Achieving Quantitative Literacy: An Urgent Challenge for Higher Education*. Washington, DC: MAA.

Stinson, D. & Wager, A. (2012). *Teaching Mathematics for Social Justice: Conversations with Educators.* NCTM: Reston, VA

Stocker, D. & Wagner, D. (2007). Talking About Teaching Mathematics for Social Justice. *For the Learning of Mathematics*, 27(3), p.17-21.

U.S. Department of Education (2011). *A Crucible Moment: College Learning and Democracy's Future*

Yankelovich, D. (1999). *The Magic of Dialogue: Transforming Conflict into Cooperation*. New York, NY: Simon & Shuster.