**Dewey, Democracy, and Mathematics Education: Reconceptualizing the Last Bastion of Curricular Certainty**

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**Abstract**

In this article we contend that attempts to foster democratic education in the United States’ public schools rarely include mathematics class in meaningful ways. We begin with Dewey’s conception of democracy and then argue that current ways of thinking about mathematics do not provide adequate foundations for democratic mathematics education. Our reconceptualization of mathematics draws on Dewey’s uniquely humanistic philosophy of mathematics. We conclude with some implications of democratic mathematics education for school and society. Thus, this project seeks to blur the theory-practice dualism, developing a theoretical argument which draws sustenance from and seeks to contribute back to educational practice.

John Dewey, often referred to as *the* philosopher of American democracy (Sleeper, 1988), forwarded the idea that democracy is realized by the twin tenets of opportunities for full development of capacities for all and the concurrent demand of social responsibility from all. Dewey described education as growth and framed it within activity. Many working under the banner of democratic education cite Dewey as an influence. While the impact of democratic education proponents on American schooling can be debated, it is interesting to note that any influence the movement has had on schooling in general has been even less evident within the realm of mathematics education. Furthermore, those working in and around the realm of democratic mathematics education seem less likely to draw on Dewey for theoretical support. This is particularly interesting, given that Dewey cowrote a book on mathematics education early in his career. *The Psychology of Number and its Applications to Methods of Teaching Arithmetic*, originally published by James A. McLel-
lan and Dewey in 1895, has received relatively little attention from Dewey scholars, mathematics philosophers, and mathematics educators (Stemhagen, 2003).

In a review of recent philosophical work in democratic education, Marginson (2006) asks a series of questions about the various projects, including: “how would they augment the formation of individual and collective democratic agency in education, particularly in schooling . . .?” (p. 208). In this article, we take Marginson’s question as a point of departure, sharpening its focus slightly, by bringing the question to bear specifically on the mathematics class. We believe that current ways of thinking about mathematics do not provide an adequate foundation for a democratic mathematics education and propose a reconceptualization of mathematics that draws on Dewey’s uniquely humanistic philosophy of mathematics.

The essay begins by framing Dewey’s more general democratic philosophy. Next, we explore the tendency for mathematics to be considered different in kind from other educational pursuits. *Psychology of Number* is considered, along with other works by Dewey, in order to depict a different way of thinking about mathematics education. We conclude by suggesting some implications for democratic mathematics education in mathematics class and on society writ large. One algebra activity is presented in detail and a second is sketched; both offer potential examples of democratic mathematics education in action. Thus, this project is an attempt—in a Deweyan spirit—to blur the theory-practice dualism, offering a theoretical argument that draws sustenance from and seeks to contribute back to educational practice.

**Dewey, Democracy, and Education**

**The Measure of Society**

Dewey (1895) indicated that the human need to measure was rooted in the desire to have better and more efficient lives. His reputation as the philosopher of American democracy is tied to his exploration of the question: What is the measure of a good society? Dewey cautions against measuring social systems based on ideal societies that exist only in one’s head (1916). Instead, he finds that the measure of society is only beneficial in its pragmatic function. That is, desirable traits in existing societies must be identified and considered in order to improve upon the practice of other existing social groups. Dewey states, “in any social group . . . we find some interests held in common, and we find a certain amount of interaction and cooperative intercourse with other groups” (1916, p. 83). The standard for evaluation of social groups derives from the expression of traits related to internal cohesion and external interaction.

Dewey describes these two elements as they are found in democratic societies. Internal cohesion, in its best democratic expression, is present when societal direction emerges from multiple, varied points of common interest. External interaction is exemplified as groups previously isolated from one another (owing to
class, education, ideology, nationality, etc.) are able to interrelate and reconstitute their social habits based on these relationships. Dewey explains:

The two elements in our criterion both point to democracy. The first signifies not only more numerous and more varied points of shared common interest, but greater reliance upon the recognition of mutual interests as a factor in social control. The second means not only freer interaction between social groups (once isolated so far as intention could keep up a separation) but change in social habits—its continuous readjustment through meeting the new situations produced by varied intercourse. And these two traits are precisely what characterize the democratically constituted society. (1916, p.86)

The very meaning and value of democracy is found in the development of individual capacity and the subsequent demand that citizens give back to society. The development of individual interests with consideration to others promises to break down existing social barriers:

A democracy is more than a form of government; it is primarily a mode of associated living, of conjoint communicated experience. The extension in space of the number of individuals who participate in an interest so that each has to refer his own action to that of others, and to consider the action of others to give point and direction to his own, is equivalent to the breaking down of those barriers of class, race, and national territory which kept men from perceiving the full import of their activity. (p. 87)

**Measuring Educational Philosophy against the Aims of Democracy**

Dewey (1916) sought to further clarify his understanding of the importance of individual development and social responsibility and the problem of blind activity. Toward this aim, he juxtaposed his democratic philosophy of education with Plato’s desire to discover and develop individual capacity to efficiently employ it in society. Dewey was concerned that an emphasis on efficiency and the prescriptive, mechanical treatment of education would lead to Platonic class divisions and enslave individuals who could not understand or control the aims of their learning and work. After presenting democratic education in contrast to Platonic ideals, Dewey set out to assess education practice in the early twentieth century. His measurement of industrial education against democratic values led him to a treatment of means and ends that may provide some insight into how one might approach mathematics education.

Dewey (1916) posited the idea that democratic communities with egalitarian values are inextricably devoted to systematic, public education. He contrasted the educational needs of such societies with the needs of other types of societies:

A society marked off into classes need be specially attentive only to the education of its ruling elements. A society which is mobile, which is full of
channels for the distribution of a change occurring anywhere, must see to it that its members are educated to personal initiative and adaptability. Otherwise, they will be overwhelmed by the changes in which they are caught and whose significance or connections they do not perceive. The result will be a confusion in which a few will appropriate to themselves the results of the blind and externally directed activities of others. (p. 88)

Dewey used Plato’s social and educational philosophy as a foil to democratic education. He acknowledged Plato’s contribution to educational philosophy in that Plato showed the importance of the links between the cultivation of one’s natural abilities and the health of a society. However, he also critiqued the limits of the Platonic project. Dewey agreed that the primary aim of education is to help the individual discover her natural equipment, foster and develop it, and use it in effective ways. He took issue with Plato’s prescriptive educational model because in it, native capacities became limiting factors that inhibited interrelations and the reconstitution of social habits.

Plato envisioned a group of philosophers who would sort people into groups according to intelligence. People dominated by appetite would provide manual labor. Educated individuals with diminished capacity for reason would be guardians of the peace and citizen-subjects. Finally, those who had the highest kind of education (abstract, universal knowledge) would lead and govern (1974).

Dewey identified similarities between the educational philosophy at the beginning of the twentieth century and the Platonic project. He believed that the educational philosophy and psychology that accompanied industrialization at the turn of the century also focused on efficiency and reinforced class divisions. Like the Platonic project, this mechanical treatment of education was at odds with the democratic values that he championed. At the beginning of the twentieth century, Dewey (1916) criticized narrow views of intelligence that focused on efficiency and productivity to the exclusion of social factors. Capitalists controlled the aims of industry and provided workers with training focused on efficient skill development, devoid of social interrelation. Dewey considered activity detached from aims, under the purposes of another, to be tantamount to slavery: “[Slavery] is found wherever men are engaged in activity which is socially serviceable, but whose service they do not understand and have no personal interest in” (1916, p. 85). In other words, the native capacities of workers were being developed and provided a social return, but their lack of self-determination and purpose perpetuated class divisions and undermined democratic principles.

Dewey’s definition of slavery cannot be separated from his understanding of ends and means. In reaction to empiricism, Dewey indicated that blind activity, disconnected from any end, does not forward understanding. In the same breath, Dewey (1929) cautioned against the rationalist’s idealization of ends as separate from or superior to means:

Regulation of conditions upon which results depend is possible only by doing, yet only by doing which has intelligent direction, which takes cog-
nizance of conditions, observes relations of sequence, and which plans and executes in the light of this knowledge. The notion that thought, apart from action, can warrant complete certitude as to the status of supreme good, makes no contribution to the central problem of development of intelligent methods of regulation. It rather depresses and deadens effort in that direction. That is the chief indictment to be brought against the classic philosophic tradition. Its import raises the question of the relation which action sustains to knowledge in fact, and whether the quest for certainty by other means than those of intelligent action does not mark a baneful diversion of thought from its proper office. (p. 36)

Dewey’s warnings about mechanical education that disconnected ends and means were not limited to education for industrial efficiency and production. Dewey indicated that “[t]he notion that the ‘essentials’ of elementary education are the three R’s mechanically treated, is based upon ignorance of the essentials needed for realization of democratic ideals” (1916, p. 192). The “essentials” to which Dewey refers are the connections between thought and its proper office, a connection between means and ends. The mechanical treatment of education presupposes that the end of education is social-capital return and earned income. Assuming that education’s end is to “make a living” or provide social return detached from significant action robs the individual of a meaningful existence because the end to which he works is unrecognizable to him.

Dewey, of course, articulated a different aim for a robustly democratic education that does not limit intelligence to a mechanical participation in means based on ends that lie outside of the activity. Instead, the aim of education must be present within existing situations. Intelligent activity allows the learner to modify actions based on identified ends. This is important for democratic societies, because only in the understanding of the original aim can the individual reflect upon existing conditions and change the target. Rigid, external aims prevent educators and students from understanding that ends are experimental, ongoing, and inextricably related to particular contexts. Furthermore, they are future means, not ultimate ends. By freeing activity through the legitimate use of aims, the potential for changing conditions exists (1916). Personal initiative and adaptability are key components of an education that measures up to democratic principles. This philosophy of education provides a foundation for the readjustment of social habits, the second element that points to democracy.

Dewey uses the imagery of a hunter to illustrate the freeing of activity, the continuum of ends and means. The hunter does not practice shooting a target with good marksmanship as his ultimate aim. Instead, this end is actually the activity that leads to another end, shooting a mobile rabbit. The kill at the end of the hunt only marks another point in the activity that leads to a meal. He goes on to say that “[e]very means is a temporary end until we have attained it. Every end becomes a means of carrying activity further as soon as it is achieved” (1916, p. 106).

The underpinning of mechanical education is that there are ultimate, abstract ends that can be externally imposed. According to Plato, these abstract and
ultimate ends are the highest forms of education and become the domain of leaders and governors. This rational form of epistemology, which purports a hierarchy of knowledge and class, separates knowledge from activity and citizens from one another. To Dewey, in a vibrant democracy, such rigid ends are undesirable and, ultimately, untenable. Furthermore, a robust education should not focus on predetermined ultimate ends, but rather cultivate a student’s ability to propose aims, construct means to achieve those ends, and evaluate when ends need to be adjusted in light of changing circumstances. While Dewey’s way of thinking about the ends of education has had some impact on many facets of the curriculum, mathematics education has remained largely resistant to such ways of thinking. We argue that this is mostly related to the widespread belief that mathematical knowledge is different in kind than other forms of knowledge. Given this belief, Dewey’s link between democracy and education does not appear to extend to mathematics education. We contend that this situation is unfortunate. Prior to exploring how a Deweyan conceptualization of mathematics education opens the door for an explicit mathematics-democracy link, we first sketch the predominant ways of thinking about mathematics that render it resistant to its meaningful democratization.

Current Ways of Thinking about Mathematics as Insufficient Foundations for Democratic Mathematics Education

There is wide acknowledgement of the social dimensions of most school-related knowledge. In science, a post-Sputnik concern for relevant, applicable science education coupled with some philosophical insight (e.g., the work of Kuhn, Rorty, and others) has led to changes in the teaching and learning of science as a school subject (Boudourides, 2003). Science class has become a place where students play the role of fledgling scientists. History class has similarly undergone fundamental changes—spurred by technological advances and disciplinary shifts in how the enterprise of history is conceived (Ford, 2006).

We do not want to overstate the case and claim that proponents of constructivist, progressive education have been able to overcome the stultifying effects of über-mechanical, fixed-aim-oriented accountability systems such as NCLB and its various state-level standards and high-stakes testing regimes. What we are claiming is that while such systems do restrict the ability of democratically oriented educators to implement meaningful and effective pedagogies, mathematics education has an added layer of resistance to democratic education. Hence, mathematics education never enjoyed the sort of metamorphosis that has taken place in other content areas. Instead, there exists a split. The unexamined, common-sense version of mathematics as objective, neutral, and extra-human has fostered resistance to the aforementioned pedagogical shifts that have taken place in other subject areas. Those working to implement constructivist reforms in mathematics education have had to work against stubborn and longstanding understandings of the discipline as dealing with absolutes. Consequently, reformers have postured against
this absolutism by offering constructivist versions of mathematics that emphasize its subjectivity and fallibility. The “math wars” have been ongoing for years, pitting traditionalists—those calling for more rigor and a “back to basics” approach to mathematics education—against reformers—those advocating a child-centered, applied approach to mathematics education.

The math wars are about more than just teaching methods and curriculum decisions. Pronounced differences as to how the nature of mathematics is conceived undergird this split. Absolutists tend to view mathematics as certain, permanent, and independent of human activity. Constructivists, on the other hand, focus on the ways in which humans actually create mathematical understandings and knowledge.

The math wars are germane to this project because we contend that both absolutism and constructivism—while each makes important contributions to the philosophy of mathematics and mathematics education—ultimately fail as philosophical foundations for a democratic mathematics education. Absolutism captures mathematics’ unique stability but does so at the expense of recognition of its human dimensions. Constructivism, on the other hand, tends to encourage acknowledgement of the human dimensions of mathematics but, in doing so, seems unable to account for the remarkable stability and universality of mathematical knowledge. Perhaps as importantly, this ideological stalemate has blocked efforts to humanize the teaching and learning of the subject. This unfortunate situation is, we argue, a main contributor to the state of affairs that has made mathematics education and democratic education mutually exclusive endeavors. How can it be that a main aim of American schooling is to foster the development of individuals capable of and interested in democratic participation and that this ethos is, at least theoretically, represented in almost all facets of the school day, yet it is conspicuously absent from mathematics class? In the end, we believe that this contributes to missed opportunities in mathematics education and in the wider project of education for democracy. For this reason, we next turn to the “philosopher of American democracy” and his ideas about the nature of mathematics in order to reconceptualize school mathematics.

**Dewey's Pragmatic Mathematics and Philosophy of Mathematics Education**

As we noted, Dewey’s ubiquitous presence in philosophy of education and, even to a certain extent, in education writ large does not carry over to the philosophy of mathematics education. This lack of influence is puzzling, as Dewey’s (1895) co-authored mathematics education book, *The Psychology of Number and its Applications to Methods of Teaching Arithmetic*, described a philosophically and psychologically based approach to mathematics education.

Dewey’s exploration of the psychological processes involved in an individual’s coming to know mathematics provides a point of entry for human elements into
a discipline (philosophy of mathematics) that has frequently worked to explain mathematics in nonhuman, antipsychological terms.

Psychology has often been viewed as something to be overcome or ignored in philosophical work, as there is a worry that mental processes act as an impediment to understanding the “reality” of the external world. This traditional philosophical conception of psychology posits a distinct line between the mental and the physical. Dewey saw this polarization as overly static and inaccurate and so he worked to mediate between tendencies that focus solely on mental or physical aspects of existence. One way he combated this way of thinking was to employ psychology in a nontraditional manner.

Dewey’s psychology is at the core of his general epistemological project. To Dewey, knowledge, belief, and psychology are inextricably linked. Dewey (1910) explains these connections in outlining his notion of “immediate empiricism”:

I start and am flustered by a noise heard. Empirically, that noise is fearsome; it really is, not merely phenomenally or subjectively so. That is what it is experienced as being. But, when I experience the noise as a known thing, I find it to be innocent of harm. It is the tapping of a shade against the window, owing to movements of the wind. The experience has changed; that is, the thing experienced has changed not that an unreality has given place to a reality, nor that some transcendental (unexperienced) Reality has changed, not that truth has changed, but just and only the concrete reality experienced has changed.... This is a change of experienced existence effected through the medium of cognition. (p. 230)

In Deweyan terms, the world is as it is experienced and, subsequently, an individual’s psychology is central to all experiential endeavors. Accordingly, philosophers are obligated to include psychology in any attempts to understand experience in any but the most reductive way. Many philosophers posit psychology as a barrier to logic, obscuring the contents of the logical, a priori realm. The Deweyan conception of logic and psychology, in light of human activity, describes psychology and even logic merely as modes by which we undertake the act of living our lives. Psychology encompasses the mental processes by which we actually think (and live). Dewey (1967) goes so far as to humanize logic as he sees it as originating from the recognition, emulation, and eventually the formalization of particularly fruitful methods of inquiry.

With regard specifically to mathematics, Dewey conceived of number as fundamentally transactional in nature—that is, it resides within the processes of mathematical activity. The understanding and use of number comes about in the wake of much experience in the empirical world and also after a great deal of rational and abstract thought. Thus, although the sensory input to which we are exposed is laden with raw information as to the multiplicity of things in nature, it does not necessarily follow that the notion of number is present. On this point, Dewey wryly notes, “There are hundreds of leaves on the tree in which the bird builds its nest, but it does not follow that the bird can count” (McLellan & Dewey, 1895, p. 23).
Dewey’s use of psychology extends beyond merely coming to know mathematics and actually find a place in his understanding of the creation of mathematics. Note that it “finds a place” in his understanding of where mathematics comes from—it does not determine mathematics, as some radical constructivists argue (von Glasersfeld, 1991). Dewey saw the development of mathematics as arising from the need to solve genuine human problems. Hence, Dewey’s philosophy of mathematics provides both stability in the form of pragmatic constraint (i.e., does the mathematical creation help solve the initial problem?) and contingency (our mathematics could be different if our lives demanded it). In this way, Dewey’s conceptualization of mathematics as inescapably psychological in nature can be used to lessen the tension between the oppositional forces in contemporary math wars. It is a means to reasonably link mathematics to human activity, making it more likely that mathematics education can explicitly address broader human aims such as democratic participation. This possibility of a democratic mathematics education will be explored later in this article.

Dewey’s descriptive account of how children come to know mathematical concepts centered on the mental activities of children as they encountered various empirical situations. The psychological processes he detailed explained how it is that ideas of “much” and “many” might lead to the more refined notions of “how much?” and “how many?” Dewey (1895) indicted that this simple sense of quantity originated from the human need to measure in order to live more efficient and better lives (p. 42).

Dewey saw the commonly understood distinction between counting and measuring as getting in the way of understandings of how children organically come to know number. Counting is typically thought to relate to determining how many of something there are, while measuring is thought to involve the determination of how much of something there is. In other words, the question is whether some phenomenon is a series of parts of one whole or a related group made up of individual units. Dewey’s pragmatic answer was that the phenomenon may be either depending on context and the needs of the counter or measurer. The reason for engaging in the mathematical activity must be taken into account when answering the question.

Thus, Deweyan mathematics can only be defined and understood by its use. The concept of a particular number (say three) does not reside within a group of three apples, beanbags, or any other objects any more than it does in the symbol, 3. Three, as a construct, emerges from activities requiring quantification (measuring) as a means to an end. Dewey and McLellan’s accompanying pedagogy accordingly focused on measurement, as all counting is measuring and all measuring is counting. Making measurement the vehicle for mathematical explorations ensured, according to Dewey, that number symbols remain linked to concrete units and encourage active, empirically oriented, and contextualized conceptions of mathematical enterprises. Thus, Dewey’s version of mathematics emphasized the interplay between empirical objects and our actions; it acknowledged the role of human
intent in the construction of mathematical knowledge. To Dewey, the development of mathematics is driven by the ways in which we use it—that is, its functions.

**The Possibilities of Democratic Mathematics Education**

A primary benefit of adopting a pragmatic, human-oriented understanding of mathematics is that mathematics class no longer bears the burden of being the place where students attempt to gain access to certain Truths. Instead, the starting points for mathematical inquiry are the multiple live issues that students possess; mathematics becomes the set of tools from which they can choose to help carry out their inquiries. In this type of mathematics class, the teacher becomes a skilled guide who can help shape student inquiries, aiding in the construction of mathematical models and the selection of appropriate mathematical tools of inquiry and in supervising the evaluation of such activities. Such an activity is detailed in Warnick and Stemhagen (2007). Next, a brief description of the activity is presented followed by a consideration of the potential for the activity to serve as a model of democratic mathematics education.

Weighted formulas are the featured mathematics in this activity. While there is a certain amount of up-front work that is required, the ultimate goal of the activity is to give students the opportunity to use this set of mathematical tools to explore areas of interest and also to give students enough experience with quantitative rating systems to see that despite our everyday perceptions of mathematics, human subjectivity is still present in such endeavors. A teacher could begin with a discussion of how we often attempt to quantify our qualitative experiences in order to evaluate or compare them. Grading is an obvious and accessible example. Students can discuss how some facets of their school experiences are more quantifiable than others; say, multiple choice tests as compared to classroom participation. The discussion might lead to ideas about how to quantify classroom participation, from the crude (raw number of in-class student responses) to the somewhat more sophisticated (triangulation between raw responses, a teacher-completed quality of response rubric, and a student’s Likert-scale self-evaluation, for example).

At this point, it should be evident that in spite of its quantification, subjectivity is still probably inevitable in the grading process and that a good system, rather than eliminating it, will minimize it and perhaps even use it to an advantage.

Now that the stage has been set, students might practice with existing quantified evaluation systems using weighted formulae. In Warnick and Stemhagen (2007), the National Football League’s quarterback rating system is presented, but any number of systems could work, from the simple—for example, the popular cooking show *Iron Chef*’s three criteria rating system, to the complex—say ELO, the chess ability evaluation system (Batchelder & Bershad, 1979). Students next might brainstorm phenomena that they have an interest in rating. They could work in groups or individually, and once they have decided upon a topic, they are one short example away from bringing to bear the mathematical tools related to weighted
formulae on topics of their interest. The teacher might use a student-generated topic or perhaps a topic of the teacher’s interest to devise and experiment with one such model. Heaton, Stemhagen, and Burbach (2000) provide a discussion of the effective use of weighted formula to rate popular songs in Algebra I classrooms. As such, it can serve as a guide for teacher planning for such an exploration.

In the culminating segment of this activity, students construct their own quantification systems in order to evaluate phenomena of their own choosing. They select the topic, choose the criteria, and decide on appropriate weights for each criterion. Next, they devise a plan to try out their creations. For example, with a song-rating system, a student could select a number of songs, order them from favorite to least favorite and then plug the data for each into the system. The degree to which the nonquantified ordering matches the results of running each through the system could suggest a successful rating system. Disappointing results could send students back to the drawing board to tweak their system. Students could work together in teams while engaging in the project of testing and improving the evaluation systems. Perhaps certain criteria were given inordinate weight in the system and the formula’s coefficients will require revision or perhaps the categories of criteria themselves failed to capture what was truly important about the thing being measured. The point here is that students should have the opportunity to engage in complex mathematical thinking and, in the process, to use mathematics as a mode of self-expression and to adjust the mathematical tools they create in order to hone their modes of self-expression.

The activity described above is but one example of a democratically aimed mathematics education. We are not claiming that, implemented in isolation, it will radically alter the way in which our students live in the world. Instead, we are attempting to show what school mathematics might look like if the broader educational aim of democracy is taken seriously. Just as no one activity in civics class is expected to create fully formed democratic participants, the weighted formula activity could serve as just one of many well-conceived activities in a democratically oriented school mathematics experience. Space prohibits lengthy treatment of additional activities, so the short description of one additional activity that follows is presented to suggest the fuller set of participatory school mathematics experiences we envision.

The visual depiction of mathematics, often by way of graphing, is a recurrent theme of school mathematics curricula from elementary through high school. Rather than simply learning to graph mathematical relationships, as is often all that is required according to current state standards, students could be required to consider a set of data from a particular vantage point and then represent the data visually in a way that would best forward the interests of one coming from the particular vantage point. Purposeful selection of graphing techniques can allow for the same data to be presented in very different ways. Engaging in this sort of mathematical activity not only builds mathematical skills but also allows students to explore the ways in which mathematics might be used as a form of persuasion.
Certainly, coming to grips with the potential political uses of mathematics is an important facet of a democratic mathematics education.

Taking the activity one step further—having groups of students represent different interests, as they interpret and visually depict the same data—could lead into the very social mathematical activity of debating which depictions are most accurate and objective, which do the best of job of forwarding the interests of those from the vantage point from which they were assigned, etc. In this way, mathematical skills are learned in context, allowing for their human elements and their democratic possibilities to be considered.

One example of possible sources of such data could be global oil production numbers presented from the points of view of major producing nations, major consuming nations, oil companies, environmental groups, and individual consumers. The point here is that various stakeholders have an interest in using mathematics for various purposes; and to the degree that students get to try this idea out, not only will they become more savvy users of mathematics but they will also, presumably, become more savvy consumers of mathematics. A robust version of a democratic mathematics education has a place for both skill sets.

**Conclusion**

Consonant with Dewey’s distinction between the externally interactive and internally cohesive requirements of democracy, the analysis of the sample activity as an example of democratic mathematics education in this final section is divided into two sections.

**External interaction**

There are certainly current examples of mathematics education and mathematics education research that address issues of social justice. We believe that these endeavors are commendable. Furthermore, such efforts are particularly valuable when, in promoting social justice, students come to recognize that freer interaction is not only okay, but desirable and even necessary given our democratic social arrangements. That said, when socially conscious mathematics education fails to rise above mere mechanical treatment of data for the purpose of exposing social justice it runs the risk of raising awareness of social issues without subsequent cultivation of the students’ desire and ability to act in such ways as to change their social habits. In other words, becoming aware of social inequalities is a necessary but not sufficient step in democratic education. Students also need to come to grips with their own agency and the role they can play in social improvement. Neither the weighted formula activity nor the sketch of the second activity, in and of themselves, accomplishes all of our democratic goals (i.e., becoming aware of social inequality and recognizing and acting on personal agency). However, taken together, one can begin to see a school mathematics experience that might work toward democratic ends.
Dewey presents logic and psychology as modes by which we undertake the act of living our lives. The recognition, emulation, and formulation of practical methods of inquiry humanize logic and incorporate mental processes related to how we think and live. His conception of mathematics education helps to demonstrate how it is that we can actually change social habits. Conceiving of mathematics as measurement allows the participant to see mathematics as a practical activity connected to a personally meaningful end. This contextual approach to mathematics emphasizes the importance of human intent in the construction of mathematical knowledge. Human intent presupposes a perception of the significance or connectedness of activity, which develops an individual’s ability to modify the means they employ. The activities presented in this article demonstrate the human intentional facets of mathematics, the ways in which mathematics can be used to empower individuals, and the ways in which mathematics can relate to and even impact personally meaningful aims or ends. Democratic societies must educate members for this kind of personal initiative and adaptability if it is to promote social mobility and the adjustment of social habits. A Deweyan approach can help increase the likelihood that mathematics class will be able to participate in this project of democratic education.

**Internal cohesion**

Developing individuals’ propensity to act according to individual initiative and adaptability is one aspect of educating for democracy; there is also a social aspect of Dewey’s democratic education that must be considered. Many constructivist mathematics reformers encourage a human understanding of mathematics through individual psychological cohesion. But this perspective often fails to adequately present the social experience of life, and specifically, of lived mathematics. Dewey presents a social and practical understanding of cohesion that turns the psychologically oriented constructivist’s understanding of cohesion on its head. According to Dewey’s pragmatic view of social life, cohesion involves more than the individual testing of a hypothesis and its adherence to an experientially constructed understanding of the world. In order to promote a democratic mathematics education in keeping with Dewey’s pragmatic philosophy, cohesion must also involve meaningful action based on shared interests.

According to Dewey (1916), social cohesion within a democracy should flow naturally from multiple, varied points of common interest. Therefore, democratic mathematics education must go beyond proofs and other externally directed exercises designed to help students grasp abstract, external realities. It must also go beyond assessing development only at the individual unit of analysis and also consider that of the group. The pursuit of democratic education requires the implementation of mathematics education in such a way that the social dimensions of cohesion are also experienced. In other words, one of the criteria for the measure of mathematics education should be the extent to which its practice creates opportunities for students to measure areas of shared interest so that they can understand the aims
of their work, adapt their means to appropriately fit the context, and learn about the nature of collective living and the worth of collective action. From the outset, the social dimensions of the weighted formula activity are clear. Rather than just doing the “same old math” in groups, the activity provides opportunities for students to listen, learn from, and work with one another.

The activity and related discussion are offered in the spirit of just one possibility suggested by a Deweyan approach to mathematics and mathematics education. To the degree that students can come to understand mathematics as a means by which to improve social and physical situations—that is, to act on and live well in the world—mathematics class can be an agent of democratic education. Helping children to acknowledge and value their potential agency should be an aim of all democratic educational pursuits and a Deweyan reconceptualization of mathematics could provide a conceptual foundation toward that end.

Notes
1. There are too many to include. See, for a few examples, Banks (2004), Beane (2005), Carlson (2002), Greene (1988), Noddings (2003), and Postman (1995).
2. We don’t want to overstate Dewey’s influence on the day-to-day operation of P-12 public education, as we believe, following Tozer, Violas, & Senese (2002) and Kohn (2000) that the efficiency progressives have had much more lasting (and often pernicious) influence on schooling. That said, Dewey is often cited in academic work in most curricular areas, but not so often in mathematics education.
3. Hersh (1997) writes of this philosophical split, dividing absolutism into Platonist and formalist camps and describing the other side of the divide as humanism (this is more or less what we refer to as constructivism).
4. Rough empirical data supports this claim that mathematics education faces additional obstacles (beyond the standards and high-stakes tests facing all areas) in implementing a democratic education. A quick ERIC search revealed 101 articles linking mathematics and democracy. Other content areas had much higher totals (social studies 2086, Language Arts/English approximately 1000, and Science 859).
5. The activity is presented elsewhere in order to accentuate the moral dimensions and possibilities of mathematics education. The ties between its moral and democratic facets certainly would not be surprising to Dewey, as Dewey’s corpus of work implicitly assumed a connection between the two. For explicit discussion of the links between morality and democracy see Dewey’s (1955) Democracy as a moral ideal.
6. For example, see http://www.doe.virginia.gov/go/Sols/mathsecondary.doc.
7. Gutstein’s (2006) Reading and writing the world through mathematics is an example of the sort of mathematics education that seeks to empower students as they learn mathematics. Thus, it is not simply mechanical treatment of data and meets an important criterion of democratic mathematics education.

References


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