**PERSPECTIVES, HISTORY, AND COUNTERCULTURES: A DISCUSSION ABOUT REFORM IN MATHEMATICS EDUCATION**

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Reform in mathematics education is nothing new. Initiatives geared to change the way mathematics is taught in US schools tend to vacillate with regards to politics, economics, and accountability. This article seeks to understand major reform initiatives throughout the past 100 years while looking at primary curricular ideologies that shape and respond to initiatives. These ideologies are neither inherently good or bad, but they tend to reflect shifts in thinking with regards to reform. That being said, there are criticisms presented with respect to social efficiency models of teaching and learning mathematics. The end result is an overview of the philosophical and reform movements along with a call for consideration of countercultures that have emerged in recent decades within mathematics education community.

*“The math wars have casualties—our children, who do not receive the kind of robust mathematics education they should.” (Schoenfeld, 2010, p.283)*

Throughout the last century, there has been considerable debate as to what should constitute mathematics curriculum and instruction in public schools. That is, *what* mathematics should be taught and *how* it should be taught. Mathematics education has evolved into what it is today as a result of major reform movements. Reform is an interesting term and it seems to encompass many conflicting views on what should be taught and how. Some reform has moved mathematics education into more progressive eras, while other reforms were derived from social and economic needs within the changing culture of the United States. At the turn of the 20th century, four major curricular views were already emerging, and each has had considerable impact on mathematics curricula in the US. Various terms have been used to describe different curricular philosophies, but generally speaking these have included humanists, or traditionalists; developmentalists, or constructivists; social efficiency educators; and social meliorists, or social reconstructionists (Abbott, Baker, Smith, & Trzyna, 2010; Schiro, 2013; Shoenfeld, 2004; Stanic, 1986).

The United States has seen a myriad of reforms in mathematics education come and go. This is in part due to “consistent reform rhetoric with little actual reform of the mathematics curriculum” (Stanic & Kilpatrick, 1992, p. 407). This was true in the early 1990s and is still true today. That is not to say there has been no change. Some educators have felt empowered to transcend mandated curricula to teach in non-traditional ways in many subject areas, including mathematics. However, walking into a fairly typical high school, one will most likely observe markings of a curriculum mostly influenced by social efficiency models of education.

The ultimate purpose of this paper is to understand major trends and reforms in mathematics education over the last 100 years. My goal is to highlight major reform movements that have shaped pedagogies and curricula in mathematics education. Moreover, within each of these movements are debates between those who hold influential views of mathematics curriculum and instruction. The debate, though, is not as simple as a two-sided argument. That being said, I feel it is necessary to discuss the current status schools before more clearly defining influential curricular philosophies which have influenced the various directions of mathematics education. Finally, I discuss emerging views that have formed a counterculture to traditional mathematics curricula and their influence on the future of mathematics education in the US.

**Schools Today**

Teachers across the US face intense pressures associated with being held accountable for students’ performances on state and national tests. In the 1990s there was a general consensus within the US population that schools should, in fact, be held accountable for how their students perform on state and national exams (Johnson & Immerwahr, 1995). With the implementation of *No Child Left Behind* (NCLB) in the early 2000s, accountability reform has heavily impacted educational practices. Smith and O’Day (1991) outline four theoretical components for accountability reform to improve teaching and learning in the US. These include creating high-quality standards that are both meaningful and uniform, designing standardized assessments that are in line withhigh-quality standards, providing support for teachers tasked with implementing the standards, and implementing accountability measures to motivate compliance (Smith & O’Day, 1991; Desmonde, 2013).

 The focus for many districts has been less on the high-quality teaching of standards and more on the supposedly motivating, accountability measures. Accountability has its roots in behaviorism with rewards and consequences for compliance and failure. Furthermore, uniform standards fail to differentiate for learners’ needs. Schools that tend to underperform often resort to modes of desperation, which have included overhauling entire faculty and implementing surveillance tactics.

These approaches are widely accepted and are reminiscent of Foucault’s (1977) notion of hierarchical observation. Constant monitoring, through mandated evaluative observations, are a result of accountability cultures stemming from top-down, educational reforms, like NCLB. Because of pressure to perform well on high-stakes tests, teachers often revert to “back-to-basics” approaches that have proven, time and again, to be ineffective (Broom, 2015). Further, accountability movements put a great deal of emphasis on measurable data to provide public ratings for schools. Grading in this waypublicly shames schools without taking into consideration demographic data and other outside social factors that may contribute to schools’ low performances on homogenized exams. Because of policy-makers’ calls for accountability, quality teaching and learning has inevitably suffered.

To no surprise, many so-called “failing” schools are generally located in areas of poverty and are often comprised of students from lower socio-economic backgrounds. Inequities that marginalized groups already face are exacerbated by teacher shortages in schools deemed failures. In order to rectify issues in these types of schools, social efficiency models of education are often implemented. New teachers arrive (some with little or no teacher preparation), who often serve as technicians, implementing procedurally- and computationally-based mathematics curricula in order that schools may raise their rankings. This crisis is the model of schooling itself and has been referred to as factory-model education (Pinar, 1994). Pinar goes on to say that “in its press for efficiency and standardization, the factory model tends to reduce teachers to automata” (p. 242). Furthermore, “the factory-model school achieves social control at the cost of intelligence, intelligence understood as including problem solving, critical thinking, and creativity as well as memorization and calculation” (Pinar, 1994, p. 242). While this is happening in schools, in general, mathematics education has not been able to escape the grasps of efficiency education.

Social efficiency models of education, in many regards, fuel false narratives around fear mongering tactics that associate schools with labels such as “failing.” In an effort to produce competent mathematics students, tactics like teaching to tests and tracking students into advanced and “regular” courses have been implemented to sort students into courses that fit their potential usefulness in society (Oakes, 2005). It then follows that those who excel in mathematics are characterized as more intelligent than those who do not. Ernest (1991) notes:

There is a widespread assumption . . . that there is a fixed linear hierarchy of mathematical ability from the least able to the most able (or mathematically gifted); every child can be assigned a position in this hierarchy, and few shift their position during the years of schooling. One important consequence of these stereotyped perceptions and expectations of pupils is the adoption of limited goals for the mathematical education of lower attaining pupils. (p. 244)

Because of beliefs like these, schools today have resorted to curricular models in mathematics which aim to fill societal needs, and thus limit students’ opportunities to pursue personal interests. Social efficiency models of education are in stark contrast to democratic ideals that should be championed in public schools. Noddings notes that choice is a fundamental concept in democracy (2013, p. 66). So, when student choice wanes for the sake of global competitiveness, democracy suffers. When students are not given equitable access to qualified teachers, democracy suffers. For these reasons, I have come to believe that access to quality mathematics education is, in fact, a civil right. Inequitable access to quality mathematics curricula is a social injustice that should not only be highlighted, but rectified.

**Philosophical Perspectives**

My interpretation of literature surrounding the history of mathematics education has been influenced greatly by my beliefs that mathematics is a subject that anyone can learn and enjoy. That being said I believe that mathematics can be an empowering force that provides people abilities to critically problem-solve issues in their everyday lives and can help students redefine their social status. Additionally, choice is an integral component of democracy which should be supported in public schools and within mathematics education. As I delved deeper into the history of mathematics education, it became difficult to completely bracket my presuppositions about mathematics education. Therefore, I decided to sift information through a critical lens, looking at ever-present power structures that enfranchise some, while simultaneously disadvantage others. The following paragraphs discuss major pedagogical and curricular philosophies in mathematics education from a historical perspective, while also providing some critique of each.

**Traditionalists**

Traditional learning has taken various forms throughout the history of education, and what is considered to be traditional in one space may not be in another. I am using the term traditional to describe a humanist, or scholar academic, perspective on curriculum and instruction (Schiro, 2013; Stanic, 1987). Generally speaking, those would be considered traditionalists include teachers and scholars who believe in preserving a Western heritage of education, where students learn basic facts through memorization that will presumably allow them to build on their learning as they progress linearly through a set curriculum. Traditionalists typically have an intrinsic love for their subject matter and are interested in passing their knowledge along to the next generation (Abbott et al., 2010; Schoenfeld, 2004).

Traditionalists and scholar academics have been around for centuries. In fact, if you have completed an undergraduate degree or taken almost any general education course found on many university degree sheets, then you have probably been exposed to this method of instruction. Essentially, scholar academics tend to believe (and which implied by their label) that teachers teach and students study. Teachers serve as scholars and students are neophytes. By its very nature, this model of instruction creates a powerful binary in that teachers are masters of their content who then teach students, who are novices (Schiro, 2013).

The pedagogies of scholar academics are very straightforward. While some may inevitably deviate from the script, the primary mode of teaching and learning happens through lecture and note taking. Freire (2000) refers to this as *banking education*, in which experts transmit, or deposit, knowledge into students, who then passively absorb information as neophytic sponges. This is not to say that this model of education is inherently bad or should be considered an inappropriate teaching style. In fact, this style of teaching has existed in cultures around the globe for millennia through oral traditions and storytelling. It can be very effective with excellent orators and for large groups of people; however, this approach does lend itself to inequitable power dynamics that can be exploited. Traditional curricula and instructional methods are primarily teacher-centered and require a scholar to be at the center. When teachers are unqualified or happen to be poor storytellers, teaching and learning both suffer. It should also be questioned as to why there is only one expert in the room, why students are subjected to this one expert, and why their knowledge is privileged over others’.

**Developmentalists**

Educational reformers come in many varieties, some favor learner-centered approaches, others view education as a way to empower the disenfranchised, and many see curriculum as a means to efficiently fill needs within societies. Developmentalists generally hold to the first view mentioned, viewing themselves within the role of “guide on the side rather than a sage on the stage” (Klein, 2003, p. 177). As students develop, their cognitive abilities change and their interests fluctuate, leading developmentalists to tailor curriculum to fit needs of students’ developmental state. Abbott et al. (2010) describe developmentalists implementation of mathematics curricula through discovery learning. This means students have choices to make in their learning, as their interests in various areas of mathematics may ebb and flow. This approach was popularized by Dewey near the beginning of the 20th century and has provided a starkly different approach to education than what had traditionally been enacted at this point in history.

Developmentalists, or constructivists, tend to believe that knowledge is constructed by individuals based on their experiences. Progressive educatorshave been vocal advocates for schooling to consist of student-centered learning experiences, where students’ experiences mimic tasks found in real life (Bruner, 1960; Dewey, 1899,1903; Noddings, 2013). This philosophy shifts attention away from teachers as primary transmitters of knowledge, thus decentralizing power. Dewey (1899) provides a metaphorical description that captures his approach to student-centeredness in that “the child becomes the sun about which the appliances of education revolve; he is the center about which they are organized” (p. 35). Dewey’s ideas have been adopted, adapted, disregarded, and resurrected over the course of one hundred years.

More modern notions of “authentic” teaching and learning—initially introduced by Newman, Secada, and Wehlage (1995) in the 1990s—formalize Dewey’s curricular philosophy and reframes it in a replicable form. In this contemporary adaptation of Dewey, Newmann et al. outline five major tenets of what can be considered authentic teaching: construction of knowledge, substantive conversation, depth of knowledge, student-centeredness, and connections to the real world (1995). Each component of authentic teaching and learning aligns with constructivists’ views of what should be taught and how. Some, including myself, argue that by simply adhering to these ideals does not necessarily constitute authentic curriculum. Authenticity can be considered subjective and relative to one’s perspective; however, the ideas of developmentalists at the turn of the century are still highly valued by many reformers today and have greatly shaped the way mathematics is taught in the US.

Constructivism, while touted by many scholars and educators, is not without critique. Shortly after WWII was a reignited emphasis on developmentalists’ philosophy and a “new math” curriculum was at the forefront of mathematics education in public schools. To remain supreme on a global scale, this new mathematics curriculum was introduced that included teaching topics like set theory in younger grades and included an increased level of abstraction in school mathematics (Stanic, 1987). As a rebuttal to this ‘new math” curriculum, Morris Kline’s (1973), *Why Johnny Can’t Add: The Failure of New Math,* claimed that constructivists’ philosophies left children lacking basic computational skills and that mathematics education should prepare students for their future careers. Klein and others cited low national test scores and began to sway public opinion about the direction mathematics education should go. With that, new math was deemed unacceptable and a *back-to-basics* approach would swing the curricular pendulum towards a more traditional approach. New math, while criticized by some, still had a prominent impact in that it promoted problem-solving, student interests, and allowed students to come to their own conclusions (Bruner, 1960).

**Social Efficiency**

Each major reform mathematics education has undergone has been argued to have resulted from efforts made by the US to be politically, militarily, and economically superior (Shoenfeld, 2004). Because of this, there has been one predominate curricular philosophy that has fueled this. In what are referred to as social efficiency models of education, students are produced from within the school system to fill particular needs in society to help in achieving economic and military superiority (Reeve, 1924; Schiro, 2013; Schoenfeld, 2004). This particular model for curriculum and instruction has the tendency to reinforce social strata, and limit opportunities. With that in mind, it has been heavily critiqued throughout its history. Whether it be reproducing lower-socioeconomic classes to fill working class jobs or grooming new elites to manage others, schools (and teachers) often cater to student potentialities based on societal norms (Anyon, 1979; Rosenthal & Babad, 1985). Some needs may be more benign, such as a need for more scientists, engineers, or people who can work in technology sectors. Whether needs are malicious or benign, it makes sense in our post-colonial, capitalist society that “social cleavages” exist, along with a catering to “group-based identities to advance [political elite’s] agendas” (Powell & Menendian, 2016, p. 22). Thus, it should be noted that within the roots of capitalist America there exists an oft-unspoken code that people of color have less potential than their white counterparts.

Some disadvantages faced by students, who are primarily of color and lower socioeconomic status, include changes to curriculum for which teachers are not prepared nor adequately trained to enact (Abbot et al, 2010; Schoeblach, 2004). In more recent years, access to quality mathematics teachers has become a recent civil rights issue, as fewer college graduates are entering the profession due to low pay and increasing (and often unfair) surveillance tactics associated with national accountability measures. As a result, school districts resort to hiring educators who have sought alternative forms of certification and many untrained, emergency certified teachers who lack basic understandings of pedagogical theory and practice (Houser, Krutka, Province Roberts, Pennington, & Faili Coerver, 2016).

While I am certainly critical of social efficiency models of education for their potential marginalize underrepresented groups, it has made some contributions to mathematics education that should be noted. First, as enrollment was beginning to soar in public schools after World War I, schools had to find an efficient way to handle the significant increase in population. Social efficiency is one way to teach large masses of people. Broadly speaking, social efficiency allows teachers to be easily be trained to follow prescribed curricula and outlines clear goals in which students are required to master. The result is students learning and teachers teaching, but questions about who is directing the curriculum and for what purposes should still be raised.

**Social Meliorists**

To add to the complexity of mathematics education’s history around reform, there is a fourth perspective that has remained mostly silent. This includes those who advocate for curricular models associated with teaching mathematics from a critical paradigm. These educators tend to focus on recognizing and questioning structures of power as they enact curricula. While more prominent nowadays, social meliorists did exist before WWI. Their beliefs were rooted in the works of Lester Frank Ward, who “saw the school as an important instrument for improving society in general, and the plight of suffering individuals in particular” (Stanic, 1987, p. 191). For these mathematics educators, their main goal is to “see the humanity behind the numbers and to use mathematics as a tool for exposing and analyzing injustices in society and as a means for convincing others of a particular (often non-dominant) point of view” (Gutierrez, 2010, p. 41).

Manyhave not accepted this view of mathematics teaching as being “real” mathematics education. Raymond (2018) notes that “themes of structural inequities and social justice is no longer viewed as an integral facet of school mathematics, even by the mathematics education community” (p. 9). While those ascribing to beliefs associated with issues of social justice were more silent at the turn of the 20th century and remained highly scrutinized today, I believe their perspectives are equally as important and should be shared alongside more predominant traditional and reform philosophies.

**A Brief History of Reform in Mathematics Education**

In the following paragraphs, I outline major reform movements in mathematics education. Each has been shaped by the philosophical views and social forces of education mentioned above but have also been influenced by major economic and political developments over the last century in “times of perceived national crisis” (Schoenfeld, 2004, p. 256). In each era, there seems to be key economic, military, or political issues that have influenced public perception of the status of mathematics education in the US.

**The Early Years**

At the turn of the twentieth century, the current state of mathematics education in the US came under attack from progressive educators whose philosophical ideals were much in line with developmentalists’ thinking (Kilpatrick, 2009). Progressive-minded thinkers encouraged teachers to “take the interest of children into account and to serve as guides rather than taskmasters, letting children learn by doing” (Kilpatrick, 2014, p. 329). These educators believed that mathematics curriculum should consist of more than “memorized classics, math, science, and history” and that schools should begin taking into serious consideration the “nature of the child as well as the needs of society” (Heilmann, 2005, p. 108).

After WWI, the US found itself in a global position of power and place of economic superiority that it had not seen in its relatively short history. That being said, more students began to seek educational opportunities, which included high school courses beyond the eighth grade. After the stock market crash that led into the Great Depression, students began to flock to public schools in droves to better their chances of gainful employment (Commission on Secondary School Curriculum (CCSC), 1938; Romberg, 2010). Because of economic uncertainty during this time, educators began to question what was being taught in schools, especially if skills and knowledge may not make a difference in gainful employment. As a result, many began advocating for democratic ideals that would promote active citizenship in a democratic society (CSSC, 1938; Romberg, 2010).

One particular mathematics educator, Whitehead (1929), was one of many who were advocating for approaches to mathematics teaching that would engage students in what he described as a sense of *romance* within the subject matter. He describes this as the “stage of first apprehension” in which the subject has “the vividness of novelty; it holds within itself unexplored connection with possibilities half-disclosed by glimpses and half-concealed by the wealth of material” (1929, p. 17). In a similar sense, other progressives, like Dewey “contended that the child and the curriculum are in conflict with one another” and advocated for a curriculum that would allow students to pursue their interests and find personal meaning within their learning(Romberg, 2010, p. 4). Further, the National Council of Teachers of Mathematics (NCTM was founded in 1920) stated that “pupils in secondary schools frequently have interests and appreciations which the school should help them develop” (NCTM, 1940). Additionally, mathematics educators advocated that public schools should not only help them pursue their interests, but develop new interests as well (NCTM, 1940). With this came pressure to create meaningful and rich curriculum that met the needs of learners, and with a growing student population this became quite challenging.

For some, mathematics at this time was deemed “too difficult and uninteresting by leaders of some local school systems that adopted this view of education” (Raymond, 2018, p. 2). As a result, mathematics curricula in some parts of the US were stripped to functional basics needed for so-called “shop keeper” arithmetic. Others, though, persisted in progressive and developmentalist thinking (Romberg, 2009; Kilpatrick, 2014). Those who continued to implement progressive curriculum during this time argued that the primary focus of mathematics should be more than a set of basic skills. Sure, learners needed to know how to practically use mathematics, but more importantly mathematics was to be seen as a mode of thinking that has the ability to impact “physical, mental, social, and spiritual types of human needs” (NCTM, 1940, p. 18). Raymond (2018) argues that by appealing to broader aims like these, mathematics can become more appealing to a diverse range of students.

Despite their best efforts at reform, Kilpatrick notes that progressive educators were “always a minority” in mathematics education and their public persona was equated with “extreme permissiveness in the classroom and a general lowering of standards” (Kilpatrick, 2014, p. 330). With the United States’ impending entrance into WWII, many had concerns about recruits’ abilities in mathematics, especially when it came to direct military needs (Reeve, 1924). The United States Army issued a call for mathematics curriculum to promote practical applications of algebra and geometry (Reeve, 1924). Klein notes:

...it became something of a public scandal that army recruits knew so little math that the army itself had to provide training in the arithmetic needed for basic bookkeeping and gunnery. Admiral Nimitz complained of mathematical deficiencies of would-be officer candidates and navy volunteers. The basic skills of these military personnel should have been learned in the public schools but were not. (Klein, 2003, p. 181)

That this was a “critical moment in the history of mathematics education. It was the first call for school mathematics to be used to gain specific skills and procedures required by a specific profession; the military” (Raymond, 2018, p. 3). From this point forward, mathematics was seen by many as a means for global advancement.

As families struggled to stay financially viable during this era, education had become a means to escape the burdens of the Great Depression and delay entrance into a national economy in shambles. With the addition of educating students around tenants of citizenship and democracy, attempts at equitable education were beginning to emerge. However, at the onset of WWII, a major schism was taking place, specifically in mathematics education, around the ideas introduced by social efficiency educators to produce students to fills needs in society. Raymond (2018) states:

Over several decades, the focus on career preparation in school mathematics would become so prevalent and pervasive that other purposes of school mathematics would disappear from policy papers and public debate about school mathematics. Ironically, in seeking to preserve and further American democracy, many in the field of mathematics education abandoned the methods which were developed specifically for those purposes in favor of more procedurally focused methods that required much memorization and little critical thinking. (p. 3)

This shift has led scholars to see mathematics education as the basis for the United States’ quest for economic and military superiority (Schoenfeld, 2010). Coupling this with growing fears after WWII during the Cold War, mathematics education became the center of debates between progressive constructivists, and social efficiency educators.

**Growing Fears and a New Math**

With progressive education beginning to wane in the US, social efficiency was seen as a practical way to teach mathematics for career-readiness, especially as public perceptions of “falling behind” other nations began to transpire. During this time, the US was in the midst of the Cold War era and there was increasing criticism surrounding the effectiveness of public education, and more specifically mathematics education (Kilpatrick, 2014; Usiskin, 1985). This “proved to be a pivotal event that revived interest in school mathematics as an area of curricular concern following decades of decline” (Garrat & Davis, 2003, p. 515). With the launch of Sputnik, the US became hellbent on winning the Space Race and mathematics education found itself at ground zero for a new reform in mathematics which became known as “the new math” (Kilpatrick, 2014; Romberg, 2009).

The new math curriculum was “an effort to bring school mathematics closer to the mathematics being taught in the university” (Kilpatrick, 2014, p. 330). This included incorporating more recent advances in professional mathematics. Particularly, “the language of sets, relations, and functions would provide not only a more coherent discourse in the mathematics classroom but also a more meaningful structure for learning. Students would be drawn to mathematics by seeing how it fit together” (Kilpatrick, 2009, p. 87). By reforming mathematics curriculum in this way, many policy makers felt that this would propel the US forward in its quest for global supremacy.

Kilpatrick notes that the University of Illinois Committee on School Mathematics (UICSM), the formation of the School Mathematics Study Group, and the report of the US College Entrance Examination Board Commission on School Mathematics all aimed to improve mathematics preparation of students for the scientific workforce (Kilpatrick, 2014). Interestingly, the UICSM notes in their report that one of the driving principals behind their work was that students’ understanding of mathematics was dependent on playing an active role in developing mathematical ideas and procedures. With this in mind, one of the major impacts of new math was the development of mathematics curriculum “for the mass of teachers who want[ed] textbooks” with the caveat of providing “opportunities for the expression of individuality on the part of the student” (Beberman, 1964, p. 23). Essentially, new math provided room for teachers to have professional autonomy, while also providing some support for what to teach.

Adding to the complexity of this era in mathematics education was the use of budding technology accessible to schools. This furthered debates over what and how mathematics was to be taught. Some argued for more conceptualization in mathematics due to emerging technology with calculators. Wilder (1970) notes that a common misunderstanding among many is that mathematics is more than simply computation and drill methods. Further, proponents of new math advocated for curriculum changes that would allow mathematics to be seen as a complex, emergent subject (Buck, 1965).

Many have criticized the new math movement for various reasons, some even referring to it as a failure (Kilpatrick, 2014; Westbury, 1980). Fey and Graeber (2003) share in this sentiment:

A balanced assessment of the reform effort suggests that many positive changes occurred in the content of school curricula, but the emphasis on abstract unifying concepts and logical precision was not as effective as proponents had conjectured. Changing the day-to-day practices of American schools, teachers, and testing proved to be a much more complex problem than the new math developers imagined, and winning community support for programs that changed traditional content and teaching was also a difficult task. (p. 537–538)

Others, though, felt as if the new math did not get a fair assessment. Davis (2003) shares that new math curricula were implemented in too few schools and where it was implemented could be considered successful. In 1973, Kline famously published *Why Johnny Can’t Add: The Failure of New Math*, which proved to be a final blow and the new math chapter came to an anticlimactic close.

**Back to Basics**

Throughout its history, public perception has had as much impact on mathematics curriculum and instructional methods as reform movements. Without public criticism from the US Army about its recruits’ abilities in mathematics, the new math movement may not have unfolded. Similarly, public backlash over the new math movement would make way for back-to-basics reformers and eventually the standards movement. *Back-to-basics* in mathematics education meant that “the curriculum returned to what it had been before: arithmetic in the 1st through 8th grades, algebra in the 9th grade, geometry in the 10th grade, a 2nd year of algebra and sometimes trigonometry in the 11th grade, and precalculus in the 12th grade” (Schoenfeld, 2002, p. 258). Curricula and instructional methods returned to be more closely aligned to those of social efficiency educators, whose ultimate aim is to prepare students for societal needs.

As previously mentioned, Kline’s *Why Johnny Can’t Add: The Failure of New Math* essentially marked the end of new math. In his publication, he claimed that new math did not sufficiently supply students with the basic procedural and computational skills they would need in order to succeed in the US economy. The primary emphasis for Kline was on basics, but he failed to share the importance of problem-solving skills, how students interpret mathematics in the world around them in pattern recognition, nor did he mention social applications of mathematics (Kline, 1973; Raymond, 2018).

Another major impact on mathematics education during this time was a public criticism of the curriculum entitled *MACOS: Man, a Case of Study*, which was funded by the National Science Foundation (NSF). A preacher from Florida, with support of a local radio station, broadcast four hour-long programs criticizing the curriculum and its “hippie-yippee philosophy” (Lappan, 1997, p. 3). Schoenfeld (2010) notes that this incident was important for two main reasons. First, national organizations like NCTM and NSF became fearful of congressional action that might be taken in a push for national curriculum, which created a lack of national leadership. Second, MACOS proved how influential politics can be when it came to curriculum reform, especially in the case of mathematics education that was in a perceived state of crisis. In the end, MACOS showed that an organized group “with no curricular experience” can influence congress to support its cause, especially if it is the special interest of politicians (Schoenfeld, 2010, p. 260).

In the early 1980s, NCTM published *An Agenda for Action* and *Priorities in School Mathematics (PRISM)*, both of which were criticisms of the back-to-basics movement. NCTM advocated for more conceptualization and problem solving. In short, NCTM advocated “that basic skills should be defined more broadly than simple arithmetic and algebraic calculation, that calculators and computers should be used at all grade levels, and that more mathematics should be required of students” (Fey & Graeber, 2003, p. 553). Despite their best efforts, calls for broadening the curriculum seemed to fall on deaf ears. This would inevitably set the stage for the “math wars” that would dominate mathematics education for the next two decades.

**The Math Wars**

As the US entered the 1980s, global economic competitiveness was a major national concern. In addition, data-driven performance was becoming an emphasis for the US, as it was a way to measure student “success” in classrooms. In 1983, *A Nation at Risk* was first made public by the National Commission on Excellence in Education (NCEE). Along with using statistics to make claims that the US was falling behind other countries, their report used ominous language to describe the current status of education in the US. Many at this time were calling for reform in mathematics education and, after a poor performance on the Second International Mathematics Study (SIMS), the direction in which mathematics curriculum would be reformed was up for debate (McKnight, Crosswhite, Dossey, Kifer, Swafford, Travers et al., 1987; Shoenfeld, 2010). *A Nation at Risk* opened doors for social efficiency educators to implement top-down approaches into mathematics curriculum since they believed ideal curriculum was not generally implemented by teachers as intended (Steffe, 1990). Essentially, *A Nation at Risk* proved to be a powerful, fear mongering tactic which initiatedmajor changes in mathematics education.

In order to combat fear-ridden claims from *A Nation at Risk*, NCTM was able to use parts of their *An Agenda for Action* as “a useful weapon in the battle to update the curriculum” (McLeod, 2003, p. 762). However, due to the short nature of their report, more work would be needed for an effective response. NCTM later responded in 1989 by producing *Curriculum and Evaluation Standards for School Mathematics.*  The document was somewhat of a compromise to appease those in favor of procedural, top-down mathematics instruction, while also creating more constructivist standards around issues of number sense and problem solving (Coburn, 1989).

Ultimately, *Standards* was unique in its approach. It provided a constructivist’s response to *A Nation at Risk* and was not the product of a governmental agency. Additionally, its focus was on meeting needs of all students, not just those who were gifted, or college bound. *Standards* was the first document to incorporate statistics into mathematics curriculum, which opened doors for efforts by social constructivists to emphasize critical approaches to teaching mathematics (Schoenfeld, 2010; Kilpatrick, 2014; Raymond, 2018).

By using constructivists’ methods to implement NCTM’s standards, curricula began to transform significantly from more traditional approaches to teaching mathematics, which included implementing group activities and discussion (Schoenfeld, 2010). However, by the mid-1990s, many anti-reform groups had been established and sought to thwart progressive movements. Looking back, this was not surprising, especially considering many parents of school-aged children experienced the new math era and its various criticisms first-hand. With political savviness, anti-standards campaigns in states like California used rhetoric that deemed standards “extremely bad,” noting that they were essentially “fuzzy crap.” Anti-reformers claimed that high standards for students would be challenged by the establishment and called for “real” mathematics to be taught in schools (Schoenfeld, 2010). With heated debates in, not only the mathematics education community, but the country as a whole, the math wars were in full force and sides were forming. On one side were mathematics educators labeled *reformers* who tended to favor constructivists’ philosophies. On the other side were anti-reformers, who were often referred to as *traditionalists*. However, this is not to be confused with humanist, scholar academic traditionalists. In this case, traditionalists of the math wars held views more in line with social efficiency educators.

Throughout the 1990s, attacks from anti-reform campaigns became more sophisticated. Schoenfeld (2010) notes that many traditionalists went so far as to create a four-step strategy to undermine the reformers. This included political maneuvering to influence textbook adoption and planting fear in the minds of parents and community members. With attacks from anti-reformers growing, counterattacks from reformers were often characterized as slow-moving. In 2000, NCTM produced its most influential reform document to date: *Principles and Standards for School Mathematics.* This document was, by some accounts, more controversial than *Standards.* But, it was released at an optimum time, considering that major legislation centered on accountability would be looming at the turn of the 21st century.

**Countercultures**

As discussed before, *No Child Left Behind* has been incredibly influential to the status of mathematics education in the United States in its attempt to hold schools and teachers accountable for students’ performances on standardized tests. It is hard to argue against politically savvy rhetoric centered around not leaving children behind, but ultimately the motives of this movement should be questioned. In the wake of accountability and Common Core standards, there has been pushback by some who are part of an emerging counterculture in mathematics education that is a stark contrast to social efficiency models of education. These educators are thinking outside of typical curricular reform to transcend factory-models of schooling that have become prevalent in recent years.

In each major reform outlined above and within the current status of schools, influences of developmentalists, traditionalists, and social efficiency educators are quite evident. Maybe just as impactful are the political, economic, and military impacts on mathematics curricula. One voice, however, has remained mostly silent until more recently in mathematics education. This perspective comes from those who advocate for criticalmathematics, or teaching mathematics for social justice (TMfSJ). Fortunately, more literature has become available in recent years around this concept and some educators are beginning to defy accountability and surveillance tactics, think outside of mandated standards, and provide students with meaningful content that connects to their lives.

For many decades, different scholars have advocated for curricula to be built around both students’ needs and interests (Dewey, 1950; Bruner, 1960; Delpit, 2012, Noddings, 2013). TMfSJ takes these ideas and extends them into building curricula around the examination oppressive power structures and exploring social injustices that students find important. Some injustices may be more pronounced than others, but whatever the case may be, providing students with opportunities to critically examine their lived experiences, and problem-solve meaningful solutions are ways mathematics educators are transcending accountability movements in the US.

One prominent advocate for TMfSJ, Gutstein (2006), advocates for students to explore themes within everyday occurrences that are often overlooked. He encourages students to think critically about existing societal norms in order to form well-educated opinions and to take action when necessary. This implies calls for cross-curricular work, allowing mathematics to break out of its traditional framework of rote skills and procedures. Further, “instructing with social justice principles in separate mathematics and social studies classrooms can keep hidden their critical context and content intersections, intersections that could provide a holistic and dynamic portrayal of both fields” (McGee & Hostetler, 2014, p. 208).

Within the context of social justice education is potential for social change to occur within students’ communities, schools, and curricula. Further, McNamee (2013) states:

Due to the political nature of teaching, mathematics teachers have choices to make. They can empower their students to be critical by exposing them to issues of injustice that they would not generally discuss in a typical mathematics classroom. Critical students grow up to become better citizens who participate in a democracy and are more likely to question the status quo. (p. 178)

Working in contexts around issues of social justice allows students to develop a less mystical perspective of mathematics (Brelias, 2015, p. 9). Delpit (2012) contends that teachers ought to learn who are children are, where they come from and where their interests lie. By valuing students and their interests, teachers, mathematics educators, and policy makers can begin enacting social change within their contexts which has potential to deeply impact the state of mathematics education in the US.

**Closing Remarks**

Reform in mathematics education in the US has taken numerous forms and has been the focus of many different interest groups. Emerging research in criticalmathematics and teaching mathematics for social justice are starting to change the existing narrative of schools and “fuzzy” standards found in reform movements. While these views are not widely accepted at this time, they are an attempt to promote equity and democratic ideals in public school—especially at in the middle grades—that have been forgotten through a century of debate over *what* and *how* mathematics should be taught in the US. As mathematics educators, we must remember that our “students are naturally curious and creative mathematics allows students to engage in uniquely puzzling questions. In addition, students are social beings; social and political contexts are inherently interesting to all students because all students are living and will be working within the confines of these contexts” (Raymond, 2018, p. 9). By learning from our students, mathematics educators can begin working within factory-models of schooling to transform students’ lives, rather than simply preparing them to fill a specific cog in the US job market.

It is imperative to learn from the history of mathematics educationand better understand the workings of different curricular philosophies at play. Reform efforts will continue to come and go, political agendas will be powerful voices in the direction of education, and philosophical debates between will continue; but, as mathematics educators, we should not lose hope in teaching students to be problem-solvers and critical thinkers. We need to learn from the best of what each philosophy brings to teaching and learning. When new reform initiatives emerge, we must be cautious and approach each with a sense of skepticism. Students’ well-being, the promotion of democracy in classrooms, educating students ought to be guideposts for examining new reform. Until reform movements are given sufficient time to determine successfulness or failure, our goal must be to work within broken systems to transcend the status quo, promote ideals that are essential to democracy, and to fight for the well-being of our students. In the end it is our students who are the primary casualties of the math wars.

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