Revitalizing Math Learning in America —
An Educator’s Guide to the Ways Character Strength Supports K-8 Mathematics and
the Common Core State Standards

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locally, nationally and internationally.

Funders
This paper was generously supported by the S.D. Bechtel, Jr. Foundation and the John
Templeton Foundation.

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Acknowledgements
We would like to thank the many educators who reviewed and helped improve this document, including:

- Carole Basile, Ed.D. Dean of the College of Education, University of Missouri-St. Louis.
- Marvin Berkowitz Ph.D., Co-Director of the Center for Character and Citizenship and Sanford N. McDonnell Endowed Professor of Character Education, University of Missouri-St. Louis.
- Karen Smith, Former principal of Mark Twain Elementary, Brentwood — a National School of Character (2011) and a Caring School Community
- Philip Fitch Vincent, Ed.D.
- Candace Tippett, Freelance Editor
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Executive Summary

Introduction/context: We establish the general need for a fresh look at mathematics, identify key issues, and frame character education as an essential tool for addressing these issues. Specifically, we show that while the United States has had more than 60 years of concern about academic standards, math still has an ambiguous role in our culture and a real but perhaps unnecessary anxiety-producing effect in schools. On one hand, strong capacity in math is seen at the individual level as essential preparation for a range of careers. Indeed, our national mathematics capacity is seen as a tool for ensuring our global economic competitiveness. On the other hand, balancing these strongly pro-math values is the negativity produced at the individual level by the ‘gate-keeper’ status of various math courses as well as general malaise about math in the broader society. As mathematician John Allen Paulos famously noted, it's OK at a cocktail party to say that you're not a math person, whereas you would never say that you just ‘don't get’ language. In short, we value math in the abstract, but we don’t really like it.

Against this background, the United States is embarking on our third effort to create meaningful change through national standards. Despite ostensibly good intentions, it is a fair question to ask whether this effort will succeed where previous ventures have not. In this paper, we take the position that without due attention to factors beyond curriculum change, the mathematical expertise targeted in the Common Core will be thinly realized at best. More specifically, we argue that various aspects of character are explicitly identified (courage, diligence, persistence, cooperation, precision, creativity, and future-mindedness), while other aspects are implicitly assumed (empathy, confidence, fairness), within the Common Core vision, and use this paper to articulate their role (and advocate for their inclusion) in math reform discussions.

Position taken: For teachers, students, and community members to embrace and realize the vision of the Common Core State Standards, a fundamental shift will be required in how we envision teaching and learning mathematics. Merely adjusting the curriculum sequence and holding workshops to orient teachers to the new standards will amount to what Tyack and Cuban have called “tinkering toward Utopia.” Efforts to double down on business-as-usual – even with increased rewards and consequences – will not lead to significant change. Instead, we need to build confidence, intrinsic interest, growth focused orientations toward mathematics, and toward learning in general. In this paper we identify specific research-supported interventions for building these character strengths and increasing academic performance in math. We articulate ways in which constructs developed within the
character education field hold the key to a more vibrant mathematical learning environment.

**Specific actions recommended:** We advocate the creation of a Dewey-inspired character-building model of “communities of inquiry” toward mathematical tasks that moves beyond training students to replicate procedural knowledge. Done well, this establishes a culture of engagement and intrigue with diverse strands of mathematics. Countering the standard objection that group work limits individual achievement, we show how participation in a community of inquiry leads to higher real achievement, both for individuals and groups. Within a community of inquiry, the scope of work is defined by the practice and content standards, while norms of group membership are defined by concerns for personal, civic, performance, and intellectual character.

To make this vision tangible, we present four extended vignettes (primary, intermediate, middle, and high school) exemplifying how a richer learning space emerges through the intersection of character education, strong pedagogy, and the Common Core State Standards. Complementing improvements in the classroom environment, we look at ways in which the community beyond the classroom can be a resource for students needing additional support or enrichment, and how parents can be engaged in these changes. We include 8 detailed lesson plans aligned to the CCSS-M practice standards and the encompassed virtue that also include opportunities for reflection by students, teachers, and families. We also articulate the relevant administrative, assessment, and pedagogic issues raised by our character-infused model, and offer a research and development agenda to guide a path forward.
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Common Core State Standards (CCSS) and Character Education: A Natural and Powerful Alliance For Student Success

The Purpose of Education

“Throughout history, and in cultures all over the world, education rightly conceived has had two great goals: to help students become smart and to help them become good.”
—Thomas Lickona & Matthew Davidson, Smart & Good High Schools (2005)

From the beginning of formal education, schools have shaped students’ social, emotional and ethical lives as well as their intellectual development. Historically, the term character education has referred to the process by which each generation seeks to pass along cultural values and shape the disposition of the young through experiences affecting their attitudes, knowledge and behaviors (Benninga, Berkowitz, Kuehn & Smith, 2003). The framers of the United States Constitution realized that maintaining and advancing the principles of “liberty and justice” would require a virtuous citizenry and that preserving it would be an ongoing challenge to succeeding generations. American education in the 18th century sought to promote the development of moral, loyal and productive citizens—citizens trained in practical matters who would actively build the new republic, and through their actions ensure the success of this new republic (Kelley, 2003; Seider, 2012). A half century later Horace Mann, the founding father of American public education, extended this mission, believing that society could “equalize the conditions of men” by providing a common learning experience for children of all economic classes. Mann wrote that building a person’s character was just as important as reading, writing and arithmetic (Kelley, 2003; Seider 2012). As recently as 1949, “character” building was widely promoted as a primary goal of American education.

“Persons with good character make a society good, and, in the long run, they lead the most satisfying lives. The importance of character is so generally understood and accepted that character is ranked by most people as of first importance in the child’s education. In a recent national poll, 34 per cent of the persons interviewed said that character education was the most important aspect of education, a proportion just equal to those who placed the mastery of the three R’s in first place. Among people who had a college education, 51 percent gave character education first place.”
—Robert J. Havinghurst & Hilda Taba, Adolescent Character and Personality (1949)

Unfortunately, in the US, societal consensus on the features and importance of character education has since declined and although its prominence in public discourse has surged and receded, only to surge again, character education has not been a significant priority for US educational policy makers for the last half century (Berkowitz & Bier 2004; Seider, 2012; Sojourner, 2013). Despite overwhelming recognition of its importance by parents
and teachers (CASEL, 2013), the US is currently absent a federal character education program. Also, while almost all the states have legislative language that supports or requires character education, commitment in terms of designated implementation time and resources, is absent. Schools wishing to implement character education programming must rely on the commitment of the school administrators, teachers, and philanthropy to support their efforts. Even so, the number of public schools implementing character education programs has recently begun to grow, albeit slowly (Berkowitz & Bier 2004; Seider, 2012; Sojourner, 2013).

This renewed interest in character education may be the a result of recent research by a diverse group of scholars and scientists — including economists, educators, philosophers, psychologists, and neuroscientists — who have begun to compile evidence that the educational policy paradigm which emphasizes academic content acquisition (as demonstrated by standardized test scores) does not address that which matters most to a child’s healthy development and future success. As Paul Tough explains in his best-selling book How Children Succeed: Grit, Curiosity, and the Hidden Power of Character (2012) what matters most is more likely to be our ability to “nurture the development of a very different set of qualities, a list that includes persistence, self-control, curiosity, conscientiousness, grit, and self-confidence. Economists refer to these qualities as non-cognitive skills, psychologists call them personality traits, and the rest of us think of these traits as character” (p xv).

Whether one uses the term character education, moral education, positive youth development, values education, social and emotional learning, positive psychology, youth empowerment, psycho-social or non-cognitive development, when it comes to K-12 programming these once distinct approaches have converged (Battistich, 2007; Berkowitz & Bier 2004; CEP, 2010). Although consensus on terminology has yet to be achieved, many scientists and practitioners agree that this convergence is accurately represented by what we think of as the field of character education. Roughly defined, this involves the investigation and intentional effort of schools to promote students’ positive development as people — intellectually, socially, emotionally, and ethically (Battistich, 2007). In this paper we take an author’s license to use the terms character, character strengths, and character education for the conceptually overlapping constructs, concepts and practices from the variety of disciplines that inform this mission.
Background of the Common Core State Standards (CCSS)

"Tomorrow's illiterate will not be the man who can't read; he will be the man who has not learned how to learn."

—Alvin Toffler, Future Shock (1970)

The roots of the CCSS go back to 1996 when a bi-partisan group of the nation's governors and corporate leaders, concerned that America was losing its competitive advantage in an increasingly globalized economy, got together and founded Achieve, Inc. – an organization they charged with finding a way to raise academic achievement and strengthen accountability across all 50 states. Eight years later Achieve released “Ready or Not: Creating a High School Diploma That Counts” (2004) which concluded that the US high-school diploma had lost its value, and that neither employers nor colleges considered most high school graduates adequately prepared for the work they would be asked to do. The authors recommended the development of a common set of rigorous K-12 educational standards as a necessary first step toward solving this problem. In 2009, the National Governors Association (NGA) supported an initiative to develop such standards in the areas of literacy and mathematics instruction. Released in 2010, and far from uncontroversial (in fact, legislatively quite vulnerable), the Common Core State Standards for Mathematics (CCSS-M) and English Language Arts (CCSS-ELA) have been adopted in all but 5 states, as of 2013.

If schools in the United States are currently failing in preparing students for their role in the 21st century economy, what would success look like? What will it take to restore value to the high school diploma and ensure that American students are actually college and career ready? Achieve Inc. provides the following definition:

“College and career readiness” refers to the content knowledge and skills high school graduates must possess in English and mathematics — including, but not limited to, reading, writing, communications, teamwork, critical thinking and problem solving — to be successful in any and all future endeavors. Of course, readiness for college and careers depends on more than English and mathematics knowledge; to be successful after high school, all graduates must possess the knowledge, habits and skills that can only come from a rigorous, rich, and well-rounded high school curriculum.


Implicit in this definition and explicit in the new standards is the fact that a K-12 education must promote the development of specific student character strengths as well as academic excellence to ensure college and career readiness and close the global achievement gap (Wagner, 2011). Recent research has found strong evidence that character strengths such as persistence, conscientiousness, and optimism rather than cognitive ability predict labor market success (Heckman, Stixrud & Urzua 2006; Lindqvist & Vestman 2011). It is
generally agreed that success in higher education, employment, and/or entrepreneurship in the 21st century will be achieved by students who demonstrate higher order mathematical understanding and superior communication skills, who can work well in teams, who take personal responsibility, are who are self-motivated, learn quickly, and have the ability to plan, prioritize and creatively problem solve (NEA, n.d.; Wagner, 2011). Consistently ranked below average for developed countries (particularly in math) on the Program for International Student Assessment (PISA) tests, US policy makers have grown increasingly concerned about our global economic competitiveness. Often, this concern results in demoralizing and counter-productive policies that encourage schools and teachers to engage in more and more of the ‘drill and kill’ mechanistic pedagogy that may result in higher test scores in the short term while diminishing students’ motivation, diligence, and persistence in the long run.

Research suggests that a significant portion of the global achievement gap in mathematical expertise as reflected on international tests has more to do with strengths of character than intellectual ability. Character education is an explicit component of the curriculum in countries that are scoring particularly high on international tests as well as in many of those that are on an upward trajectory (Woessmann & Hanushek, in press). In fact Singapore, Taiwan, South Korea, Australia, and the UK have nationally established and well-funded character education mandates which they believe are be making significant contributions to their superior academic achievement.

Researchers Erling Boe, Robert Boruch, and Henry May (2002) looked at the difference in mathematics achievement among countries and in aspects of students’ character (i.e. diligence & persistence). To do this they created the variable Student Task Persistence (STP) and operationally defined it as the thoroughness with which students answered the demographic and life circumstances questions that are included with international tests. Analyzing the 1995 Trends in International Mathematics and Science Study (TIMSS) exams and demographic surveys completed by 8th graders in more than forty countries, the researchers discovered that STP explained 53% of the between-nation variability in math achievement. The U.S. ranked thirty-third in STP while Finland ranked sixth and Korea ranked fourth. Between countries, the differences in STP turned out to be the single best predictor of how countries performed on the actual substantive portion of the test. STP was more predictive of a country’s test scores than socioeconomic status, class size or any other factor that has been studied. Students in Finland and Korea answered more of the demographic survey than students in the United States. When May repeated the analysis with the 2009 PISA data, he found the same dynamic: Half the variation between countries’ scores on the PISA math test could be explained by how much of the personal questionnaire on average students filled out in a given country (May, Duckworth, & Boe, in press).

Although interest in character education as well as the body of research supporting its efficacy is growing, many schools hesitate to do anything that may be perceived as
potentially detracting from test preparation (Benninga et al., 2003). Additionally, many K-12 educators believe the implementation of the new Common Core State Standards (CCSS) will only accentuate the pressure schools currently feel to perform academically. Others, we among them, see the implementation of the new CCSS as an opportunity to reverse the unproductive focus on test preparation (Hattie, 2008). Our hope (somewhat tempered by previous experience) stems from what we see optimistically as a reciprocal and potentially powerful alignment of CCSS and character education (CEP, 2013). The Common Core State Standards in Mathematics (CCSS-M), with its associated shifts in mathematics praxis, offers educators the opportunity to provide students with learning experiences that will contribute to multiple aspects of students’ character development — thus supporting the revitalization of the role of character education as a priority in the national agenda.

Recognizing the pressure to meet academic standards and the great emphasis on math proficiency, in this paper we address the history, challenges and opportunities offered by the Common Core Standards and provide examples of the ways in which a focus on building character strengths will promote student success in K-8 mathematics instruction.

**Common Core State Standards in Mathematics (CCSS-M): Concepts and Shifts**

The Common Core Standards are intended to provide clear learning goals for all K-12 students, with each step designed to assist students in the college and career readiness process (NCAPB/CCSSO, 2010). Although the last three decades in American education have been characterized by the setting of high academic standards, no significant growth in graduation rates and rates of youth employment have been achieved. More than one million American youth do not graduate from high-school with their class and nearly seven million youth ages 16 to 24 are unemployed. The question then remains as to whether adoption of the Common Core Standards will differ significantly from past attempts to raise achievement by raising academic standards.

In terms of mathematic achievement it is important to note that differences exist in US models of instruction and the models used by our international counterparts. After an extensive review of the international education systems that are producing superior achievement in mathematics (Phillips, 2007), designers of the CCSS-M determined that in comparison to these successful systems American education was “a mile wide and only an inch deep.” To improve this situation the new CCSS-M development was guided by three principles — focus, coherence, and rigor:

**Focus** is the act of concentrating interest or attention on central or critical knowledge and skills, and it involves the substantive reduction in the scope of content covered by the CCSS-M. This reduction in curriculum scope gives teachers and students more time to engage in mastery learning and deeper critical thinking, conceptual understanding, and real-world application of learning.

**Coherence** involves the formation of a unified whole. It includes supporting
student understanding of the logical interconnection of mathematical concepts within and across grade levels. The standards are designed around learning progressions that lay out the trajectory of student learning from grade to grade, helping teachers expand on students’ prior learning and illustrating how foundational knowledge will be used to master future learning goals.

**Rigor** is the quality of demanding learning that is accurate and thorough—including optimally difficult challenges. Rigorous learning is both hard and satisfying, it necessitates an “environment in which each student is expected to learn at high levels, each student is supported so he or she can learn at high levels, and each student demonstrates learning at high levels” (Blackburn, 2012, p. xxx).

**Common Core State Standards in Mathematics: K-8 Components**

The CCSS-M standards are organized in grade bands of K-5, 6-8, and High School. In this paper we focus on the K-5 and 6-8 grade bands. Structurally, the CCSS-M standards have two strands — content standards and standards for mathematical practice.

**Mathematics Content Standards:** The content standards have a user-friendly organizational structure, with related standards arranged into clusters, which in turn are arranged into larger groups called domains:

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<thead>
<tr>
<th>K-5 Domains</th>
<th>6-8 Domains</th>
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<tbody>
<tr>
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<td>Ratios &amp; Proportional Relationships (gr. 6-7)</td>
</tr>
<tr>
<td>Operations and algebraic thinking</td>
<td>The number system</td>
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<tr>
<td>Number and operations in base ten</td>
<td>Expressions and equations</td>
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<td>Numbers and operations with fractions</td>
<td>Functions (gr. 8)</td>
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<tr>
<td>Measurement and data</td>
<td>Geometry</td>
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<tr>
<td>Geometry</td>
<td>Statistics and probability</td>
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**Standards for Mathematical Practice:** As in the past, the new content standards describe what students need to know and be able to do to be considered proficient in math. For this analysis, we will also look to the mathematic practice standards that describe what students ought to be as they do. According to the 2010 National Governors’ Association (NGA) Center for Best Practices & Council of Chief State School Officers (CCSO), “Proficient students are experimenters and inventors” they are active problem-solvers who possess
the “courage to plunge in and try something,” they think strategically and adapt known strategies to new problems. They possess the qualities and habits expert mathematical thinkers seek in apprentices. Individually and with their classmates, they discover ideas and gain insights that spur them to pursue mathematics beyond the classroom walls (p. xx).

The inclusion of the CCSS-M practice standards make clear that acquiring content knowledge is necessary, but not sufficient for students to achieve mathematical proficiency. Strengths of character are necessary for the effective engagement of the eight practice standards:

1. Making sense of problems and fostering perseverance in the problem-solving process
2. Concrete and abstract thinking
3. Constructing viable arguments and critiquing others’ reasoning
4. Modeling with mathematics
5. Strategic selection of tools
6. Attending to precision
7. Looking for and making use of structure
8. Looking for and expressing regularity in repeated reasoning

Successful achievement of these practice standards will require the intentional development of attitudes and behaviors that have historically been called excellences or virtues.

**Tapestries of Character Development and Education**

*We are what we repeatedly do. Excellence, therefore, is not an act, but a habit.*

— Aristotle

Aristotle used the phrase ἑθικαὶ ἀρεταί for excellences of character. Aristotle taught that virtue relates to the proper function of a thing. He believed the optimum function of the individual and the aim of all deliberate human action was the achievement of “flourishing” or “well-being,” which includes happiness among other positive traits. The inclusive term for these concepts is “eudaimonia.” Aristotle suggested that in order to attain happiness, one has to develop good character or moral virtue. Doing this requires an individual to undergo the first phase of being habituated, by teachers, and by experience. After completing the first phase, the individual progresses to the next phase, which consists of consciously and reflectively choosing to do the right things. In Aristotle's view as expressed in *Nichomachean Ethics*, we are all capable of becoming better and we are responsible for the actions that express our character. The best people come to live life this way with their intellect and character developing together towards the highest possible human virtue, known as practical wisdom.
Dimensions of Character

Developmental psychologist Marvin Berkowitz defines character as “the complex constellation of psychological characteristics that motivate and enable individuals to function as competent moral agents” (Berkowitz, in Nucci, 2014). Phrased differently, according to the Character Education Partnership, good character “consists of understanding, caring about, and acting upon core ethical values.” (Berkowitz, Schaeffer, & Bier 2001). While a precise and widely agreed upon definition of character does not exist, lay people and educators tend to agree that a person’s character is multifaceted and develops over time through an integrated system that includes cognition, affect, and behavior. This is often framed colloquially has involving the head, heart, and hand. Character is multi-dimensional, and good character is made up of positive qualities called virtues. Benjamin Franklin developed a classification of strengths of character that is still in use today. Franklin praised the merit of leading ordered, humble, industrious, sincere, clean, and just lives, and actively worked to strengthen these qualities in his own character (Wright, 2013). More recently, Martin Seligman and Christopher Peterson (2004) compiled a classification of character strengths and virtues. Based on an extensive review of historical and cross cultural literature, these scholars and their colleagues describe 24 individual character strengths which they group under 6 broad categories of virtue – wisdom, courage, humanity, justice, temperance, and transcendence.

Thomas Lickona and Mathew Davidson (2005) propose one of the most elegant and educationally useful conceptualizations of character as encompassing two broad dimensions -- performance character and moral character. In their view, “performance character consists of qualities such as effort, diligence, perseverance, a strong work ethic, a positive attitude, ingenuity, and the self-discipline needed to realize one’s potential for excellence in academics, co-curricular activities, the workplace, or any other area of endeavor.” Moral character in turn “consists of the qualities—such as integrity, justice, caring, and respect—needed for successful interpersonal relationships and ethical behavior” (p.18).

Lickona and Davidson’s model is grounded in a multi-year study of what they considered to be “smart and good” high schools. They identified all the factors that emerged from their analysis and grouped them under just these two headings and thus devised the equation:

\[
\text{CHARACTER} = \text{Performance Character} + \text{Moral Character.}
\]

Another model of character is described in a recent Kappan article discussing the purpose of education. David Shields (2011) identifies 5 dimensions of character (four dimensions at the individual level and one dimensions at the group level) that are particularly relevant to K-12 education – moral character, performance character, intellectual character, civic character and collective character.

- **Performance character** describes how people approach tasks: Do they work hard and persevere in their efforts? Are they focused on doing their
best or just getting by?

- **Intellectual character** describes ways in which people approach information and ideas: Do they keep an open mind and weigh evidence? Are they willing to reconsider previously held beliefs in light of new information?

- **Civic character** moves past the individual to describe ways in which people show their commitment to their community: Are they committed to improving the quality of life for themselves and others? Are they seeking to improve the local environment?

- **Moral character** generally refers to how people interact with each other. Issues of kindness, consideration, and empathy are key here. What does it mean to be a good person, and to see the value in others?

- **Collective character** refers to the patterns of school life, the procedures and routines that reflect the norms, goals, values, expectations and teaching, learning and leadership style. Key issues here include maintaining an atmosphere of excellence, respect, and trust. Do students and teachers feel safe and happy at school? Does our school inspire adults and children to excel?

In the pages ahead we will apply Shields’ model of character to the teaching and learning of mathematics in K-8 classrooms. We do this to explore how best to use character education principles, strategies, tools and resources to help schools fulfill the CCSS-M vision of mathematical proficiency for all students. Additionally, we examine the ways in which the CCSS-M offers educators the opportunity to infuse character education into math instruction. In the following sections of this paper:

- We elaborate on each of Shields’ 5 dimensions of character.
- We examine a small subset of the character strengths that must be nurtured if students are going to master the new K-8 CCSS-M.
- We identify evidence for theory-based strategies that measurably influence or impact mathematics achievement.
- We provide illustrative examples of strategies teachers can employ to promote multiple aspects of student character.
- Finally, we consider the role of collective character and the ways in which comprehensive character education promotes an inspiring school culture and significantly improved mathematics achievement.
- In the Appendix we offer detailed lesson plans that align to CCSS-M and address aspects of character development.

**Performance Character and Mathematics Positivity**

Performance character describes a set of virtues people use when they approach tasks or goals they want to accomplish. Lickona, and Davidson (2005) propose that “Character isn’t
just about doing the right thing in an ethical sense; it is about doing our best work. If that is true, then character education isn’t about helping kids get along; it is also about teaching them to work hard, develop their talents, and aspire to excellence in every area of endeavor” (p. 373). In the case of K-12 students, performance character refers to those aspects of motivation and behavior that are nostalgically referred to as “the other side of the report card” — items such as “comes to class prepared,” “pays attention,” “uses time wisely,” “participates in class discussions” and so on. These classroom behaviors, which may carry over onto the playing field and every other dimension of school life, demonstrate highly valued and mutually reinforcing virtues such as confidence, diligence, and perseverance.

**Promote Self-Confidence and Self-Efficacy:** A critical step in learning any subject matter is having a positive attitude and confidence in one’s ability to learn new things. Renowned psychologist Albert Bandura (1993, 1997) demonstrated that confidence in one’s ability to be successful at a given task — what he termed ‘self-efficacy’ — influences how a person thinks and behaves. Regardless of what may objectively be true about their capabilities, students’ subjective beliefs about their abilities guide the choices they make, the effort they invest, and the persistence they display when they encounter obstacles (Walton & Spencer 2009). Recent research has substantiated that students’ perceptions of their abilities are often better predictors of academic performance than their actual abilities (Pajares & Schunk, 2002), and that even talented students regularly fail to achieve their academic potential. Unfortunately, many students, parents, and even teachers are less than confident with regard to their abilities in math, and this may have unseen consequences.

A study of math anxiety in college students found that elementary education majors had the highest levels of math anxiety on campus (Hembree, 1990). According to a 2005 poll of 1,000 American adults, twice as many respondents said they hated math as said they hated any other subject (AP-AOL News poll, 2005). One in five adults in the United States lacks the math skills expected of an eighth grader, according to the United States Center for Educational Statistics. The results of the 2003 National Assessment of Adult Literacy (NAAL) revealed that only 13% of American adults were at the level of math proficiency that would enable them to “compute and compare the cost per ounce of a food item” (Kutner, Greenberg, Jin, Boyle, Hsu, & Dunleavy, 2007). In a random sample of adult Americans, 78% could not explain how to compute the interest paid on a loan, 71% could not calculate miles per gallon on a trip, and 58% were unable to calculate a 10% tip for the waiter that served them lunch in a favorite restaurant.

**Combat Math Negativity in Youth:** Given what we know about typical adult feelings regarding math, we should not be surprised to learn that many children and adolescents have negative feelings about math. In Learning to Love Math: Teaching Strategies That Change Student Attitudes and Get Results (2010), Judy Willis, a neuroscientist turned elementary math teacher, articulates a host of reasons for students’ negative attitudes. These include their parents’ and significant others’ negative attitudes toward math, low expectation of success as a result of previous negative experiences, inadequate skills and
preparation for doing math successfully, failure to be engaged in math through their individual learning strengths, and fear of "looking dumb" if they make mistakes (Good, Aronson, & Inzlicht, 2003; Stephanou 2012; Willis, 2010). A growing body of research into the psychological and behavioral consequences of math negativity supports Willis's (2010) classroom experience with students who lack self-confidence in math (2010). These negative consequences include high stress, low motivation, feelings of helplessness and hopelessness, decreased class participation, boredom, diminished tolerance for challenge, failure to keep pace with the class, behavior problems, and avoidance of the advanced math classes necessary for subsequent professional success (Diener & Dweck, Hansen 1994; Stephanou 2004, 2012; Willis, 2010).

Several strands of social learning and expectancy theory research have demonstrated that students tend to actively approach activities when they are confident they can succeed, and they tend to avoid activities in which they lack confidence (Kyriacou and Goulding, 2004). How do students develop confidence — part of the psychological construct known as self-efficacy? Researchers have identified three main sources of self-efficacy: past success or failure; vicarious experiences or observation of another's seen as similar to one's self; and verbal/social persuasions or messages received from others (Usher & Pajares, 2008). When teachers, parents, and peers are authentically encouraging, self-efficacy for a task increases (DeWitz, Woolsey, & Walsh, 2009), as does the effort the student is willing to put forth. However, when parents, teachers, or peers appear to expect a less than successful outcome a student's confidence decreases and she becomes less motivated to persevere in the assignment, further exacerbating the problem. This quickly devolves into a vicious recursive cycle. Teachers can employ strategies that encourage memories of positive school experiences and use those memories to activate students' feelings of competence and motivation.

Teachers can trigger positive memories at the beginning of a new year by prompting students to write about a math activity from a previous year that they really enjoyed. Almost all students should be able to remember at least one positive math experience, although teachers can open this up and use alternative prompts such as "What was the most exciting thing you learned last year?" or "What was the best math activity you can remember doing from any prior year?" This confidence-building activity can be the first assignment of a math journal that students will keep all year (and that can be passed on to the next year's teacher).

Another beginning of the year activity to include in a math journal might be a math experience autobiography. Willis (2010) shows interest in her students as individuals by giving them the opportunity to tell her what they liked about math and what previous teachers did that they found particularly helpful or unhelpful. She provides students with prompts to help focus their answers. To a great degree the prompts use a positive lens, such as: What do you like about group work? Describe your best study habits. What do you do when you get stuck? How do you memorize material? What did you do differently when you
were most successful compared to when you were less successful? What gets in the way of studying? What did past teachers do that helped you learn best? In what ways have you used math outside of school? Do your parents or other close relatives have jobs or hobbies where they use math?

Student responses are windows into how individual students may experience the subject, classroom, or school differently. Willis says she likes to preface the writing assignment by telling students “As your math teacher, I want to understand your unique view of mathematics, identify your strengths and weaknesses, and help you have the best possible experience in math this year.” Willis uses these accounts to help her choose strategies to use or avoid in differentiating learning activities for individual students.

**Develop Diligence and Perseverance:** Building a student’s tendency to persevere in the accomplishment of goals has historically been a targeted outcome of most character education programs and is explicitly included in the first CCSS mathematics practice standard, “Making sense of problems and fostering perseverance in the problem-solving process.” Perseverance in academic tasks is defined by Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson, & Beechum (2012) as a “student’s tendency to complete school assignments in a timely and thorough manner, to the best of one’s ability, despite distractions, obstacles, or level of challenge” (p.9), thus encompassing the character strengths of diligence, self-discipline, ability to delay gratification, grit and tenacity (Duckworth & Quinn, 2012). In fact, after an extensive review of the literature Farrington, et al. (2012) developed a logic model showing how what they call non-cognitive factors influence academic performance. In their model, academic mindsets lead to academic perseverance, which increases academic behaviors that ultimately result in improved academic performance.

**Exercise Smartness:** Farrington et al’s (2012) model reflects the convergence of multiple lines of psychological research. This research includes foundational work in personality, motivation, and social learning theories (Bandura, 1977; Dweck, 1986; Dweck and Leggett, 1988; Eccles, Adler, Futterman, Goff, Kaczala, Meece, and Midgley, 1983) that support the notion that students are more likely to persevere through difficult problems and succeed academically if they have a ‘growth’ as opposed to a ‘fixed’ mindset. Students with a fixed mindset believe that ability is a fixed or innate characteristic over which they have little to no control. Aristotle’s view that virtues are developed through individual effort and grow with intentional practice is consistent with the idea that ability is under a person’s control and a result of their own actions. Framed in a growth mindset, ‘smarts’ can grow through strategic effort.

A number of relatively small interventions have demonstrated success in ameliorating the causes and consequences of math negativity discussed above. Over the last several years, rigorous randomized field trials have shown that seemingly “small” social-psychological interventions—typically brief exercises that do not teach academic content but instead target students’ thoughts, feelings, and beliefs in and about school—have had significant
and lasting effects on educational achievement. The impact of these interventions has been sustained even over months and years (Garcia & Cohen, 2012; Gehlbach, 2010; Walton & Dweck, 2009; Walton & Spencer, 2009; Wilson, 2006; Yeager & Walton, 2011). The Charles A. Dana Center has applied this line of theory to middle and high school math classes across the United States, producing large effects on educational outcomes including reducing the percentage of students who repeat algebra from 24% to 9% (Stano, 2012; Yeager & Walton, 2011). Several “gold standard” experimental studies have produced significant gains in middle school math achievement after implementation of activities designed to introduce and reinforce the idea that intelligence is malleable and, like a muscle it grows stronger with effort (Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003; Mueller and Dweck, 1998).

**Praise Effort Rather Than Ability:** In a series of experimental studies, Mueller and Dweck (1998) gave fifth-grade students a moderately difficult set of logic problems. After completing the problems, one group of the students received praise for their ability (“That's a really high score. You must be very smart at these problems”), One group of students received praise for their effort (“That's a really high score. You must have worked hard at these problems”). A third group received praise that was neutral (“That's a really high score”). All students were then given a very difficult set of problems on which they all performed poorly. Finally, students were given another set of moderately difficult problems. On this final set of problems the ‘neutral praise’ students performed at the same level as they had on the first set. The ‘effort praise’ group of students did better than they did originally and asked for more challenging problems in the future. Most notably, the ‘intelligence praise’ students solved 30% fewer problems and asked for easier problems in the future. Just one sentence of praise that reflected the theory that intelligence is fixed undermined students’ performance after an experience of failure, while just one sentence of praise that acknowledged the positive effect of effort promoted improved performance after an experience of failure.

**Teach that Intelligence Grows:** Blackwell et al. (2007) conducted a study in which middle school students were randomly assigned to one of two groups. One group included a treatment condition which involved attending an eight-session workshop designed to teach study skills and share the findings of scientific research showing how the brain grows connections and ‘gets smarter’ when a person exerts effort to accomplish challenging tasks. Those middle school students assigned to the control group were given an eight-session workshop in which they learned only study skills. Results showed that students who learned what has come to be called the ‘growth’ mindset theory earned better math grades over the course of the year while students in the control group continued on the downward math trajectory that typically begins in middle school. Learning about study skills alone was not sufficient to produce better performance in math; students needed the motivation to apply the skills. Other strength-promoting interventions based on these theories have generated similar academic gains in diverse populations (Aronson, Fried, & Good, 2002;
Sustain Intrinsic Motivation by Eliminating Rewards: Most teachers have, at times, resorted to bribery as a motivational strategy. Students earn candy for correct answers, cartoon shaped erasers on walk-to-school-day, and school store dollars for turning in homework, helping a classmate master a difficult concept, or simply picking up trash on the playground. Extrinsic rewards are pervasive in schools despite several decades worth of research demonstrating that rewards often reduce rather than increase the desired behavior. Deci (1971) found that college students who solved cube puzzles for their own enjoyment were less likely to engage in puzzle solving after being paid to do so. Lepper, Greene, and Nisbett (1973) found that preschool children who were given a “good player award” for drawing a picture were less likely than students that did not receive an award to draw pictures during free play later in the day. This counterintuitive finding has been replicated many times using different activities and subjects of various ages (Lepper & Greene, 1978). A recent meta-analysis of 128 studies conducted between 1971 and 1999 confirmed the finding that extrinsic rewards can significantly and substantially undermine intrinsic motivation (Deci, Koestner, & Ryan, 1999).

Performance character strengths are mutually reinforced by the activities that develop effective intellectual, civic and moral character. It is important to recognize that these dimensions of character are not distinct but highly integrated, and that the choice of individual character strengths discussed below and in the accompanying glossary is illustrative only, and far from exhaustive. In the following discussion we review research that demonstrates the value of character-focused strategies to mathematics achievement. Research-supported strategies for building academic confidence and perseverance as well as other character strengths include class meetings, values affirmation, parent involvement and journaling. Below we provide examples of their use in the teaching and learning of mathematics.

Intellectual Character and Mathematics Achievement

Usually categorized under performance character, intellectual character has recently gained its own identity (Baehr 2013; Dow, 2013; Tishman, 1995; Ritchard, 2002). Intellectual character describes ways in which people approach concepts and information. In the Character Education Partnership’s (CEP) Eleven Principles of Effective Character Education Sourcebook (2003), Kathy Beland concludes that “character has not only to do with how people interact with others (i.e., whether they treat others with fairness, respect, honesty, and kindness) but also how people interact with thoughts and ideas (i.e., whether they are curious about things, open to considering other viewpoints, and committed to pursuing truth and understanding)” (vol. VI, p. 18). One of the most widely cited intellectual virtue frameworks is Habits of Mind Across the Curriculum: Practical and Creative Strategies for Teachers (Costa & Kallick, 2009). Habits of mind describe the process of cultivating a disposition toward behaving intelligently when confronted with problems.
for which an answer is not immediately available. The focus is on meeting challenges that require strategic reasoning, insightfulness, perseverance, creativity, precision and craftsmanship. In his recent book titled *Intellectual Character: What It Is, Why It Matters and How to Get It* (2002), educational researcher Ron Ritchhart reports on an in-depth study of exemplary teachers and concludes that a person of strong intellectual character is curious, open-minded, reflective, strategic, skeptical, and truth-seeking.

Jason Baehr, author of *Inquiring Minds: On Intellectual Virtues and Virtue Epistemology* (2012) and founder of a new charter school dedicated to the development of intellectual virtues, defines intellectual virtues as the personal qualities or character traits of a good thinker, learner, or inquirer. Baehr further identifies a selection of intellectual virtues – curiosity, autonomy, attentiveness, carefulness, thoroughness in learning, humility, open-mindedness, courage, and perseverance — which he endeavors to develop in his undergraduate students (2011). Below we explore several intellectual virtues as they relate to the CCSS for K-8 Mathematics.

**Carefulness and Precision:** The development of intellectual carefulness is targeted throughout CCSS-M, both implicitly and explicitly. For instance, intellectual carefulness involves paying close attention to details, accuracy, and associations in both the acquisition and presentation of information. It promotes the deep foundational knowledge needed to persevere successfully in solving increasingly difficult and abstract problems. Mathematically proficient students continually ask themselves “Does this make sense?” Being careful in K-8 mathematics can include showing the details of the procedural steps one takes to solve a problem and checking one’s work using alternative methods. When students have thoroughly and carefully engaged in intellectual inquiry, they gain the confidence to thoughtfully consider and meaningfully respond to challenges and critiques (Dow, 2013).

Closely related to carefulness, precision, one of the 16 Habits of Mind (Costa & Kallick, 2009) appears explicitly in the description of Math Practice Standard 6: “Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning” (NCAPB/CCSSO, 2010). This language-rich standard gives early elementary teachers the opportunity to build on the strengths of the more verbally and/or artistically inclined student. For example, in *Math Literacy and the Common Core* (2012), author Steven James describes a 3rd grade activity that engages students in an interactive process of creating and acting out skits or plays that help students become fluent and precise in their use of math vocabulary. For example, students play the roles of math characters such as Equation, Equal, Variable, Plus, Minus and the numbers One through Ten. The play begins with Equation acting like a braggart
and bully. He proclaims to the audience that he is the most important character in the math kingdom and details all the functions and characteristics that make him the most ‘special’ of characters. Equation concludes that nothing in the kingdom can happen without him. The other math characters roll their eyes and introduce themselves and their definitions. They happily work together, rearranging themselves into a variety of math problems and explaining their functions to the audience. In the end, Equation comes to see how integrated the characters are and how each one helps him accomplish his goals. Equation is properly humbled and promises not to make such hasty and self-centered claims in the future. With this type of creative math activity, teachers can engage students in fun and relatively errorless math, as well as in discussions related to conflict management and anti-bullying strategies. The play can be performed for parents and peers allowing the whole school community to experience the fun of math.

**Courage:** The ability to act despite one’s fear is discussed in the preamble to the mathematical practice standards which explicitly states “Proficient students are experimenters and inventors”—they are active problem-solvers that possess the “courage to plunge in and try something” (NCAPB/CCSSO, 2010). Similarly, Taulbert (1997) argues that “Courage in today’s classrooms involves making a commitment to excellence in the face of uncertainty, adversity or the absence of support” (p. 95). Many students are fearful of speaking out in class, especially if they are unsure of a solution strategy or if their ideas are contrary to those of their peers. If we aim to promote intellectual courage in all our students, teachers must become adept at establishing and maintaining safe and supportive classroom environments (i.e. environments in which students have many opportunities to actively grapple with difficult or new problems and feel free to make mistakes). Class norms and routines can be designed to promote a sense of trust, confidence, and psychological safety that allows students to take risks, admit errors, ask for help, and struggle along the way to higher levels of learning (Delpit, 2012).

**Teaching Civic Character and Mathematics**

The United States is said to be the first nation founded on the shared commitment of all citizens to the protection of equal rights. Although we have often fallen short of its most lofty ideals, our American democracy is characterized by “government by the people,” “social equality,” and “majority rule” (American Heritage Dictionary, 2000). John Dewey (1916) asserted that, “Democracy is a mode of associated living, or conjoint communicated experiences” (p. 93) under which citizen participation is premised on informed opinions, self-reflective practice, open-mindedness, and a toleration of diversity. Civic character involves how one participates in the national democracy as well as in one’s local community. American civic character includes commitment to the common good and understanding and respecting due process. Having good character does not simply mean being competent as an individual. Good character also includes being committed to making
positive contributions to one's community, and to participating in a democratic way of life based upon justice, equality, and respect for all people (Battistich, 2007). How do children develop democratic values & skills? Consistent with a Deweyian perspective, (1899, 1916) this paper shares the perspective that children develop the knowledge, skills, values and habits necessary for active and effective participation as citizens in a democratic society through direct experience as members of a participatory school/classroom community (Battistich, 2007).

**Democratic Decision-Making:** One of the most comprehensive character education programs, the Child Development Project (CDP), developed academically integrated strategies to intentionally provide students with the experience of membership in a democratic community. The Child Development Project sought to promote feelings of belonging, shared values, participation and influence, and opportunities to work cooperatively toward the attainment of common goals (Battistich, 2007). One of CDP’s original aims was to cultivate a “balance” in social attitudes and behavior by promoting the contemplation of one’s own rights and needs and the rights and needs of others (Battistich, et al., 1991). By integrating the learning strategies of class meetings, cross-age buddying, positive discipline and whole-school activities, CDP schools helped children learn to balance personal and group goals (Perloff, 1987; Waterman, 1981). These programs also improved students’ school connectedness and academic performance (Solomon, Battistich, Watson, Schaps, & Lewis, 2000). These positive program impacts were still measurable in a follow-up study conducted years later (Battistich et al, 2004). CDP researchers investigated whether the student effects of the original elementary school implementation were maintained through middle-school. They found that, in comparison to controls, students who attended high-implementation elementary schools were more engaged in and committed to school, were more deeply engaged in a greater number of prosocial activities and had fewer problem behaviors than comparison students. Program students also had significantly higher academic performance than their matched comparison students during middle school (Battistich et al, 2004), suggesting that comprehensive character education implementation may have additional and on-going positive impacts on students.

**Class Meetings:** One of the most successful CDP strategies—class meetings—has been widely adopted and adapted. Originally conceived by William Glasser in *Schools Without Failure* (1969), class meetings enhance students’ sense of belonging and responsibility to the classroom by providing opportunities for all students to express their opinion and contribute to class decisions (Developmental Studies Center [DSC], 1996). This pedagogical strategy, an integral component of many character education programs, always involves the whole class sitting together in a circle. Class meetings can be utilized to “check in” with the class at regular intervals to solve whole class problems, build consensus, plan events, grapple with a moral dilemma, or to consider and choose how and when to engage in a unit of study.
**Morning Meeting/Responsive Classroom**: Amy Dousis and Margret Wilson in their book *Doing Math in Morning Meeting* (2010) offer several examples of morning meeting activities that engage students in errorless confidence-building math while practicing democratic decision-making and cooperative learning skills. In the following example of a morning meeting math activity, a first grade class engages in the process of fairly choosing a single field trip destination from the four or five available choices. First the teacher and students gather in a circle to discuss the field trip options and the decision-making process. Then the teacher makes a large grid on the board and labels the field trip choices at the bottom of the grid columns. Then each student puts a check mark in a cell on the grid (creating a neatly spaced stack – one on top of the other) in the column representing his or her field trip choice. Students add up the checks in each column and note that the check marks in the grid create a bar chart. Students can discuss the democratic principle of “majority rule” and whether they could think of a better process for choosing a field trip destination. Using this method to make class decisions gives each student voice and fosters students’ sense of belonging (Berkowitz & Bier, 2005). Additionally, teachers can extend or vary the activity and get kids moving around the classroom by having students form a human bar chart in which they line up in columns that represent their choices.

**Moral Character and Math Teaching Motivation**

*To educate a man in mind and not in morals is to educate a menace to society.*
— Theodore Roosevelt

Proponents of character education would agree with David T. Hansen (Senger & Osguthorpe, 2013) that a central aim of education must be the cultivation of moral agents: “that is, of persons with a humane, reflective, and responsible approach toward other people and the shared features of public life” (p. vii). Recent research (Althof & Berkowitz, 2006; Bergman, 2004; Blasi, 2005; Higgins-D’Alessandro & Power, 2005; Sherblom, 2012) into how individuals develop as moral agents is producing a growing body of empirical evidence suggesting that the concept of moral character — a core sense of oneself as a moral person — is critical to moral agency. Moral character involves knowing, caring about, and ‘doing the right thing’ in an ethical sense, including acting with justice and honesty. Shields (2011) describes moral character as “a disposition to seek goodness,” or to act in ways that are kind, helpful and true with regard to the needs and interests of other
people. Thus, moral character is primarily relational and other-oriented, with representative virtues being empathy, benevolence, caring, and compassion.

Aspects of individual character, including moral character, are often discussed in terms of specific virtues, as we do above. Another conceptualization is offered by Dewey (1909), in his framing of moral values as part of a pragmatic social intelligence. A person faced with moral choices needs the situational awareness to understand the relevant issues and make a choice that is appropriate for the time and place. A different set of circumstances may call for a different response. While it may seem odd to consider the moral dimensions of mathematics education, we believe it might just hold the key to sparking a new enthusiasm for math in both teachers and students, especially those most at risk of negative math outcomes.

Teaching Math Morally and Teaching Morality

Student moral development is both implicit and inevitable in schools and classrooms (Narvaez & Lapsley 2008). The adoption of comprehensive character education offers teachers and administrators the opportunity to seriously consider the moral dimensions of teaching and learning and engage in an intentional, transparent and deliberative approach to the moral mission of schools and teachers as they see it. That said, we contend that supporting the development of moral character in students requires that teachers be responsible for modeling behavior and organizing a learning environment committed to both teaching morally and teaching morality. Teaching morally involves providing all students with ethical and excellent learning experiences—having fair, honest, caring, supportive, ‘demanding,’ and skilled teachers and learning activities. Teaching morality involves explicitly engaging students in opportunities to think, grapple with, and dialogue about moral choices that are present in the school environment and the wider world, and virtues such as justice, courage, and integrity that can help students face life’s challenges with character.

Teaching Math Morally

*Kids don’t learn from teachers they don’t like.*
—Rita Pierson

Keep a Relational Orientation: As Marvin Berkowitz (2011) says “...you know the three Rs of education, reading, ‘riting, and ‘rithmetic? Well, the three Rs of character education are relationships, relationships, relationships” (p.115). Teaching morally in today’s schools requires a relational orientation in addition to mastering an evolving set of best practices. It involves developing expertise in a complex and dynamic process of modeling enthusiasm for the endeavor of learning, and deep interest and care for both the students and subject
matter. Best practices include coming to see the learning environment from the students’ perspective, developing a repertoire of effective educational strategies, understanding motivational theory and having the ability to match theory based strategies to individual students. Teaching morally involves more than just modeling moral behavior. It includes assigning and supporting achievable, even optimal challenges, and tapping into students’ moral motivations. In this way student character can be promoted, creating a sense of value for mathematical understanding, supporting academic persistence, and enabling small accomplishments in a virtuous cycle that builds students’ competence and confidence.

Evidence has begun to mount demonstrating that character strength building considerations — those aimed at developing the positive beliefs, attitudes and dispositions of students — can produce lasting improvement in students’ academic achievement, ability to manage conflicts, health and overall life outcomes (Battistich, 2007; Bier, Schmidt, Shields, Zwarun, Sherblom, Primack, & Rucker, 2011; Proctor, 2013). In contrast to remedial approaches aimed at fixing what is wrong with students, a character building approach applies learning theory and the associated teaching strategies from a perspective of helping students attain their academic potential and become confident learners by focusing on the sources of support and strength in their lives (Caprara, Barbaranell, Pastorelli, Bandura, & Zimbardo, 2000; Bier, Zwarun, & Warren, 2010). In the following paragraphs we discuss a sampling of theories, empirical studies, and classroom applications that have produced positive results in mathematical performance.

**Focus on Positive Teacher-Student Relationships:** When asked about what influences students’ achievement, principals, parents and students emphasize the teacher-student relationship (Hattie, 2009). The perception of the importance of these relationships is borne out by a large body of research. Cornelius-White (2007) conducted a meta-analysis for which he identified 119 studies that took place in 2,439 schools, involved 355,325 students and 14,851 teachers, and measured 1,450 effects of positive teacher-student relationships. His analysis found that teachers’ positive relationships with students had a large effect on student achievement with outcomes being highest in critical/creative thinking, and math. Further, Cornelius-White cautions that students who dislike school and do not wish to attend do so primarily because they dislike the teacher. He concludes that improving teacher-student relationships requires that teachers be able to empathize with students—“see their perspective, communicate it back to them so that they have valuable feedback to self-assess, feel safe, and learn to understand others and the content with the same interest and concern” (p. 23).

Those who teach in high poverty schools where students may see little relevance to pursuing education and are mistrustful of teachers may need to be especially intentional and conscientious about establishing caring and academically demanding teacher-student relationships. In a study of students attending an academically elite magnet school, Pedro Noguera (2009) found that a barely
believable 80 percent of the black male students did not feel that their teachers supported or cared about their success in their class, a feeling shared by significantly fewer but a still shockingly high 46 percent of white male students. When children believe their teachers don’t believe they will succeed or are not interested in teaching them they may “dis-identify” (i.e. a psychological coping strategy that allows an individual to maintain self-esteem in the face of failure) with the academic domain. For example, a student for whom math does not come easily may stop seeing herself as a “math person,” and a student who is not doing well in math may dispense with his goal of being an engineer, thereby relieving the stress he is experiencing. Strategies that ameliorate these negative student perceptions center around promoting a sense of belonging in students—a sense that they belong in the school community and “club” of scholars (Delpit, 2012). In this paper we use the term *school belonging* as a multi-dimensional construct that includes the notion that one feels comfortable, attached to, and part of school, as well as feeling that the activities that take place there are appropriate and of value to the student.

**Enhance Personal Relevance and Being Known:** Motivation research provides convincing evidence that students pay closer attention and invest more effort when learning activities are personally meaningful and/or related to their lives outside the classroom (Krapp, 2002; Schiefele Krapp, & Winteler, 1992; Stipek, 2002). Hulleman and Harackiewicz (2009) conducted an experimental study based on the expectancy-value model of motivation in which 9th grade students wrote between 1 and 8 essays over the course of a semester. Students in the control group wrote essays summarizing their coursework while the intervention students generated and wrote about reasons why their coursework was relevant to their lives. There was a .80 grade point (out of 4.0) boost at the end of the school year for students with low expectations for success in class who received the intervention. Reflection on the personal relevance of coursework can be integrated into student math journals.

Another way teachers can get students’ attention and ensure that students feel personally “known” is by incorporating students’ individual interests or personal information into math problems. Asking a math question that uses the name of a student’s pet, siblings, street or hobby creates connections between students’ interests and classroom activities and demonstrates that teachers are interested in students as individuals. In his book, *Lessons from the Classroom* (2003) Hal Urban describes how he developed the technique of greeting each student at the classroom door every day. Urban wanted to make education more personal without taking time away from academics. His belief was that reaching out with a personal greeting every day was a way to convey a sense of belonging and acceptance to each student. This may be especially important where academic identities are fragile. Distinguished author and educator Lisa Delpit, in her latest book *Multiplication Is for White People: Raising Expectations for Other People’s Children* (2012), warns that “when teachers stumble over the unique names common to a place, then there is a deep disconnect. As one New Orleans child summed this up, “I don’t like it when they don’t say
my name right.” Teachers can and should use stealth in gathering personal and background information about students. Teachers can practice the correct pronunciation of student names by having students introduce themselves before taking roll on the first day of class and then playing name games in which students interview each other and then introduce their partners and something they learned in the interview. Teachers can pick up additional “connecting” information in class meetings, math journals, parent conferences and by simply observing and listening to kids as they go about their day (Willis, 2010).

Promote Teacher-Student-Parent Relationships: Homeside Activities (DSC 1995) are short activities that the teacher assigns periodically for students to do at home with the family. Homeside activities can connect school learning with family experiences and viewpoints. Homeside activities can also involve students in discussions with family members about diverse topics such as family history, values, and school experiences including non-threatening math activities. This element of the elementary CDP project was designed to help family members connect with their child’s education (Battistich, 2007). The goal of this component is to help families experience school as a welcoming, supportive place and to strengthen families’ support for students’ social, ethical, and intellectual development. Intentionally including activities that introduce CCSS-M learning activities will help parents experience math as fun and potentially reduce their own math negativity.

The pipeline toward careers in science, technology, engineering, and mathematics (STEM) begins leaking in late elementary school when students start choosing NOT to participate in science fairs and math enrichment activities. Student disenchantment with more challenging math and science continues in middle school and then in high school as students choose to take the minimum allowable math and science courses. Harachiewitz et al (2012) conducted an experimental study that targeted parents with a relatively inexpensive intervention that consisted of mailing two brochures and reference to a website that highlights the usefulness of STEM courses. This relatively simple intervention led students whose parents were in the experimental group to take, on average, nearly one semester more of science and mathematics in the last 2 years of high school, compared with the control group. Harachiewitz et al (2012) concluded “Parents are an untapped resource for increasing STEM motivation in adolescents” p.899. This study has implications for reducing the math negativity that often surrounds students and saps their confidence and motivation.

The design of Harachiewitz et al's (2012) intervention is practical and consistent with the conclusions of a substantial body of research evidence. Hattie (2009) analyzed the results of 11 separate meta-analyses of parental involvement and found that across all measured variables parental aspirations and expectations had the strongest relationship with student achievement. Parental communication about school learning and progress had a moderate size effect, and parental supervision at home was weakest. Hattie concludes that schools need to work with parents to make their expectations appropriately high and challenging, and then work in partnership with children and the home to realize, and even surpass,
these expectations. Too often, the alienation of the home from school reduces the initial expectations. One study found that, when their children started school, 98 percent of the parents considered education to be very important to their children's future and two-thirds of these parents expected their children to attain diplomas and degrees. By the time they left elementary school, these ambitions had been doused and the parents mainly wanted their children to “get a job” (Clinton et al., 2007).

It is important to recognize that as children progress to higher level math, parents may lack the confidence and background knowledge to help their children with math assignments. Schools may want to consider what they can do to provide parents the support they need to help their student succeed in their math studies outside the classroom. Some schools initiate programs such as Parent U which aim to teach or refresh parents' knowledge of basic math skills and allow parents to learn and practice communication strategies they can use to support their children's learning at home. Many schools have periodic Family Math Nights (Thompson & Mayfield-Ingram, 1998) during which games and group activities are undertaken to help parents and children experience math as fun and engaging. All schools can provide parents with information and reminders that parents positively influence children's math achievement simply by communicating the relevance and importance of math and by reinforcing the idea that math success is achievable through strategic student effort.

**Motivate through Self-affirmation and Personal Values:** First proposed by Claude Steele, the theory of self-affirmation posits a psychological concept premised on the notion that people are motivated to protect their view of themselves as good, moral, and efficacious (Sherman & Cohen, 2006; Steele 1988). Students will experience levels of stress that inhibit learning when their sense of self-worth and integrity are threatened. Self-affirmation theory proposes that reminding students of diverse, positive aspects of themselves – especially those that are unrelated to the perceived threat – can significantly reduce feelings of threat and enable students to stay motivated and function more effectively (Sherman & Hartson, in press; Wentzel 2001). Randomized control trials of self-affirmation interventions in which students were asked to write about personally meaningful values have produced improvements in math performance (Yeager, & Walton, 2011). In the following paragraphs we describe several studies that utilized and/or promoted aspects of individual character in the service of improving attitudes and math performance in students most likely to experience the negative consequences of math negativity.

Cohen, Garcia, Apfel, and Master (2006) found that a short 15- to 20-minute writing assignment in which suburban seventh graders were asked to reflect upon and write about things that were most important to them (such as their personal interests and relationships with friends or family) increased the achievement of Black students and
reduced the gap in grades between Black and White students by nearly 40% by the end of the semester. With only a few additional writing exercises at critical times (the beginning of the school year, prior to standardized tests, and near the holiday season) the effects persisted over the next 2 years (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009). The lowest-performing students benefitted most, with their rate of remediation or grade repetition dropping from 18% to 5% (Cohen et al., 2009). This type of intervention and the positive results have been replicated with 5th graders and college students (Yeager & Walton, 2011). Professional development for teachers to incorporate writing interventions that invoke student strengths seems extremely practical and supports the literacy curriculum as well as math achievement.

Shnabel, Purdie-Vaughns, Cook, Garcia, & Cohen (2013) analyzed student values-affirmation essays and found that those who wrote about social belonging (activities that made them feel more socially connected to others, such as family events or playing soccer with friends) had the largest gains in academic performance. African American 7th graders and college-aged women who wrote about social belonging showed significant academic improvement, suggesting that this type of intervention may help explain the gross underrepresentation of negatively stereotyped minority and female students in STEM fields (Shnabel, et al, 2013).

Feelings of belonging are especially fragile during school transitions, such as the transition from elementary school to middle school, middle school to high school and high school to college. Students that may be negatively stereotyped are especially vulnerable at these times. Affirming one's sense of belonging can play an important role in affirming one's overall sense of self-worth. Walton and Cohen (2007, 2011) reported on a 1-hour social belonging intervention in which college freshmen were shown statistics and quotations attributed to ethnically diverse students that described how feelings of non-belonging are a normal and temporary part of adjusting to a new environment. The freshmen were then asked to relate their own experience with that discomfort by writing an essay and speaking in front of a camera – materials they were told would be used to help students in the next entering class. Positive gains in GPA by implementation students when compared with control students were found in first year GPAs and maintained at the 3-year follow-up. The authors stress that students were not aware that they were the target of the intervention; rather they believed they were helping future students, not being helped themselves.

Interventions like these help students form positive math identities and take full advantage of supportive learning environments in which opportunities for student growth, committed teachers, and a solid curriculum already exist.

**Teaching Morality and Math**
**Grapple with Moral Dilemmas:** Judy Willis (2010) recalls the following ‘teachable moment’ from her 5th grade math class.

A student in my math class learning about positive and negative correlations asked when this knowledge would be useful in ‘real life.’ I asked his classmates for suggestions, and they provided a number of examples, such as comparing the amount of money earned by different professionals and years of schooling, or comparing the weight of a car and its gas mileage. After a few minutes, another student asked how the graphs we were using would help her in a future job. I asked her what job she had in mind, and she said working at a retail clothes store. I explained that if her goal was to be a clerk or cashier, she would probably have no use for the knowledge. However, if she wanted to be a manager, she might want to find which factors in potential employees correlate with the successful fit of an applicant in a job. For example, she could keep records on different variables among employees—such as age, race, hair color, years of school, and gender—to see if any of those variables had a positive correlation with the number of sales made by those employees. I knew that I had included some controversial variables, and I wanted to see if students would respond. To my delight, they did. A lively discussion ensued about the legality and ethics of both looking for links between gender or race and sales success and whether such data should be considered by corporate management in making hiring decisions. I knew we were off topic and wouldn’t finish the day’s math lesson, but the value of these students having this discussion (and, indeed, it was student-centered, as they bounced their ideas and concerns among each other with minimal input from me) was more important than the day’s math. These students were considering topics that they could someday actually confront in their work lives (p.121).

**Engage through Social Justice:** In the example above Willis opportunistically connects math to the real world of her student’s aspirations and then extends the learning into the realm of ethical dilemmas and consideration of social justice issues. Social justice topics are often intrinsically motivating to students. Engaging students in project-based mathematics within a social justice context motivates students to think critically and apply math skills to real world problems. Once students are engaged in a local project, like finding the concentration of liquor stores or fast food restaurants in their neighborhood and comparing it to the concentration in a different community, or a global project like comparing the industrial waste or emissions produced by various countries, they can map their finding using Google Earth and produce striking visuals for public display. In this type of activity students deeply engage with the concepts of area, density, and ratio. *Rethinking Mathematics: Teaching Social Justice by the Numbers*, Eric Gutstein, and Bob Peterson (2013) tell us that teachers can make mathematics more lively, accessible, and personally meaningful for students, who in turn, learn in more depth. They provide many examples of
social justice projects – including several that have produced change. For instance, in “Tracking PA Announcements,” students collected and analyzed data to convince their school administration to reduce the number of obtrusive PA announcements (p. 208).

Collective Character and Mathematics Achievement

Traditional character education is often characterized disparagingly as transparent attempts to habituate students to the behavior required by the dominant culture, or as nothing more than a superficial approach to moral education. While this may be true of some character education efforts, most of today’s experts agree that the best approach to character education is a fully integrated whole school initiative that involves the collective commitment of all stakeholders (Bier & Berkowitz, 2010; CEP, 2012; Vincent & Grove, 2012). Students learn to identify and process social conventions within the core values of the school community and have opportunities to learn practical reasoning skills in supportive learning communities. Further, in these communities the moral mission of the school is integrated into all aspects of the educational process, and the moral mission defines the collective character of the school. Thus Shield’s conceptualization of character as including both an individual developmental aspect and a group or collective aspect is particularly appropriate, especially in light of recent research establishing the strong relationship between a school’s collective character and student success (Bryk & Schneider, 2002; Hattie 2008; Hoy & Davis, 2006; Hoy, Smith, & Sweetland 2002; Goddard, 2001; Goddard, Hoy, & Hoy, 2000; Goddard, 2003a; Thapa, Cohen, Higgins-D’Alessandro & Guffey, 2012).

Unfortunately the growing body of evidence supporting the critical nature of the collective character of schools is another area in which the terminology, definitions and distinctions are ill-defined. School climate, school culture, school context, school atmosphere, school ambience, and school health are constructs found in the research literature with a great deal of conceptual overlap but little definitional consensus. Far from distinct, these constructs and related literatures all highlight the importance of a socially and academically positive and supportive school character that underlies student growth and maturation across all domains (Lovat, Toomey & Clement, 2007). In this paper we use school character as an encompassing term including the central principle that positive collective character gives psychological, social, and academic support fundamental to student development and academic achievement. In the following paragraphs we highlight aspects of what research has shown to predict or influence mathematics achievement including trust, teacher collaboration, collective efficacy, student peer influences, social networks (Hattie, 2008), and school leadership. We follow this with two examples of school character focused initiatives that resulted in student gains in mathematics (Berkowitz et al. 2011; Marshal & Caldwell, 2007).

Teacher Collaboration: Distinguished researcher Asa Hilliard reports that many people and policy makers believe that teachers should collaborate to find the magic bullet of
effective teaching - while he believes the data show that teacher collaboration is the magic bullet (Delpit, 2012). This conclusion is supported by a recent large-scale study (Leana's, 2011) of the relationship between students’ progress in mathematics and the quality of their particular teacher. The study assessed the education, experience, and mathematics teaching ability of more than 1,000 fourth- and fifth-grade teachers in 130 New York City elementary schools and the mathematics progress of their students over the course of one year. The teachers that scored highest on education, experience, and teaching ability were also those with the strongest faculty relationships and opportunities to collaborate. As expected, students of high-ability teachers outperformed those of average and low-ability teachers. Students of low-ability teachers performed worst with one surprising exception: students of low-ability teachers in highly supportive and collaborative faculty settings performed just as well as students with average ability teachers. That said, these findings also suggest that schools that promote and maintain authentically collaborative organizational character may be able to deflect some of the negative consequences students face from having low ability teachers (Leana, 2011). As author Carrie Leana concluded:

“In trying to improve American public schools, educators, policymakers, and philanthropists are overselling the role of the highly skilled individual teacher and undervaluing the benefits that come from teacher collaborations that strengthen skills, competence, and a school’s overall social capital.” (p.1)

—Carrie R. Leana

**Collective Teacher Efficacy (CTE):** Research has shown that analogous to student self-efficacy, teachers with high confidence in their ability to successfully promote student learning put more effort into lesson preparation, are more open to new ideas, and persevere in the face of obstacles (Jerald, 2007). Similar to teacher self-efficacy, collective teacher-efficacy reflects the shared beliefs of teachers and administrators that the efforts of the faculty as a whole will succeed in promoting student learning (Hoy & Miskel, 2005). Collective teacher efficacy creates a work environment that builds teacher commitment to the school and improves student performance. The most promising implication of this line of research, suggests Jerald (2007), is that self and collective efficacy perceptions are not fixed in stone. Bandura (1993) reported that the positive effects of CTE on student academic performance outweighed the negative effects of low socioeconomic status. Goddard, Hoy, and Hoy (2000) studied 452 urban elementary teachers in 47 schools and reported that between-school differences in collective efficacy had a stronger positive relationship with mathematics and reading achievement than low socioeconomic status had a negative relationship. This suggests that in schools with otherwise similar demographics, principals who work to build collective teacher efficacy will make greater strides toward closing the achievement gap in their schools (Brinson & Steiner, 2007). After accounting for other demographic factors such as race, socioeconomic status, and gender, the school’s CTE remained a strong predictor of academic performance, explaining 53% of the difference in mathematics achievement between schools.
Collective Student Trust, Peer Influences and Social Networks: Curt M. Adams (2013) investigated the effect of collective student trust on school identification, self-regulated learning, and math and reading achievement in 1,646 students nested in 56 urban elementary schools. Adams found that student trust in their school positively contributed to their identification with school, internal control over learning tasks, and math and reading achievement. Adams’ research extends a body of research that shows higher levels of school connectedness are associated with higher GPAs; and a positive sense of school community is associated with positive academic attitudes and motives among students (Anderman, 2002; Maddox & Prinz, 2003; Marchant et al., 2001; Osterman, 2000). Additional support and a more nuanced understanding of the power of social connections and peer influences is being explored through social network analysis. In a pioneering study of peer group influence Maroulis and Gomez (2008) investigated the relationship between the degree of student connectedness to peers and their academic achievement. Findings indicated that the number of network connections (peers) and the academic achievement of individual students were dependent on the level of peer achievement in the network to which a student was attached. Student membership in a network of high performing peers had a positive impact on grades, whereas membership in a network of lower performing peers was negative.

Leadership: There are no leader-proof schools (Berkowitz & Bier, 2013). School leaders have a powerful influence on faculty performance and school character. Principals set school priorities and influence the shape of the school norms, values, beliefs and attitudes necessary to promote a stable and supportive learning environment that make up a school’s character (Bossert et al. 1982). The connection between positive school cultures and leadership is supported by educational research (Leithwood 1992, Hallinger and Heck 1998, Freiberg 1999, Sergiovanni 2001, Leithwood et al. 2004; Berkowitz & Hoppe 2009) and the impact of school character on student achievement has been established (Thapa et al., 2012). School leaders also have a powerful impact on faculty quality and performance via their hiring practices, power-sharing and decision making style, support for professional development, support for teacher collaboration, and ability to inspire and retain teachers (Berkowitz, 2012). A recent study investigating the turnover rates among 50,000 math and science teachers found that teachers who felt they had administrative support and respect were 70 % less likely to leave their position (Groome, Rankin & Wheary, 2012). A study of beginning teachers in New York City showed that working conditions, and specifically their relationship with the school leadership, was the most important determinant of teachers’ career decisions (Groome, Rankin & Wheary, 2012).

Illustrative Examples of Comprehensive Character Education

CharacterPlus® Way: One evidence-based character education model that exemplifies the comprehensive school-wide approach, supports the promotion of the school’s collective character, and produces significant improvement in math test scores is The CHARACTERplus Way. This model aims to change the school environment to foster students’ ethical, social, and cognitive development. The model seeks to influence the school environment by developing staff members’ and students’ sense of belonging,
instilling respect and trust in teachers and students, providing support for adult and student learning, and fostering a collaborative learning and working environment for students and school staff. In an era of high stakes accountability and an increasingly demoralized educational workforce, the CHARACTERplus Way offers schools a morale building and appreciative improvement process that inspires excellence in school staff and demonstrably improves students’ academic performance and conduct (Marshal & Caldwell, 2007). The CHARACTERplus Way has been implemented in more than 230 schools serving over 100,000 students, and recently completed the rigorous review required for inclusion in the National Registry of Evidence Based Programs (NREP).

Ideally, CHARACTERplus Way is implemented throughout a school district (kindergarten through grade 12) by collaborative leadership teams. The process is led by school leadership teams, which include the principal, at least two teachers, a counselor or social worker, and two parents or other community members. The intervention consists of a 3-year holistic process that enables each school to develop initiatives and adopt components that meet its unique needs. In year 1, the leadership team is trained in the 10 essentials of the intervention (i.e., community participation, character education policy, identified and defined traits, integrated curriculum, experiential learning, evaluation, adult role models, staff development, student leadership, and sustaining the process) and in creating coalitions for identifying character education initiatives. The team then facilitates school, parent, and community member involvement in developing the character education initiatives for inclusion in the school curriculum. In years 2 and 3, the leadership team helps each school implement the individualized character education program. Students learn to identify and embody social conventions within the core values of the school and community, and have opportunities to learn practical reasoning skills in schools where character education is integrated into all aspects of the schooling process. The efficacy of this approach has been established in two large-scale experimental studies. In one study, implementation schools demonstrated a significant drop in student discipline referrals, particularly in areas related to bullying behavior. In the other, math and reading test scores in moderately implementing schools increased nearly 50% (Marshal & Caldwell, 2007).

**LACE Approach:** A more organic use of character education as a school turn-around strategy is illustrated by Ridgewood Middle School, a 2006 National School of Character. Underlying the implementation and success of this character education initiative was the school administrators’ prior participation in the University of Missouri-St. Louis, Leadership Academy in Character Education (LACE). Developed and run by Marvin W. Berkowitz, Sanford N. McDonnell Professor of Character Education and Co-Director of the Center for Character and Citizenship (CCC), LACE is a professional development program for school leaders that focuses on the design and implementation of an effective, comprehensive character education initiative. LACE takes a developmental and holistic approach to leadership development, employing a year-long series of workshops and other experiences through which school leaders learn to shepherd school reform initiatives that
serve the moral formation as well as the social development and academic achievement of their students.

In the *Handbook of Prosocial Education* (2011), principal Kristen Peltzer tells the story of Ridgewood Middle School’s (RMS) journey from school district ‘black sheep’ to National School of Character. RMS, then and now, enrolls five hundred mostly poor rural students in grades seven and eight. In the first quarter of 2001 five hundred RMS students were failing six hundred courses, prompting the district to change the school administrators. Thus, RMS began its character education-based journey of transformation in 2001 when two graduates of Berkowitz’s LACE program Tim Crutchley and Kristen Peltzer were assigned to the school as principal and assistant principal. When Crutchley and Peltzer took on the leadership of RMS it had the reputation of being the district’s dumping ground for ‘bad teachers’ (Haynes & Berkowitz 2007). This led to a school climate in which there was very little collective efficacy for student success. In the words of Kristen Peltzer,

> The appearance of the school [in 2000] was deplorable; unkempt with every inch of the bathrooms, locker rooms, and bleachers covered with graffiti, profanity, and racial slurs. A police officer had to be stationed at the school because of the daily violence and drug use. No other school in the district, not even the high schools, had a police officer. Attendance was low and standardized test scores were even lower. Only 30% of the students met the NCLB standards in communication arts and only 7% did so in mathematics (Berkowitz, Peltzer, & Johnston, 2011).

Consistent with their LACE training, Crutchley and Peltzer began by diagnosing the problem: RMS students did not feel that their teachers cared about them and they didn’t feel connected to the school. Despite the appalling test scores, these administrators chose to concentrate on changing the school’s collective character. Due to neglect and abuse the physical plant was in utter disrepair so they set about cleaning it up. They administered a needs assessment and tried to design initiatives tied to the results. They articulated a vision of a staff that served student social and emotional needs and invested in professional development to support it. They modeled good practice, provided support and applied pressure for teachers to either join the character education journey or transfer out of the school. One-third of the staff was quite receptive and over the next two years two thirds of the staff were replaced with teachers who shared the vision. Both Crutchley and Peltzer modeled “going the extra mile” and established procedures that supported student success. When they realized that teachers routinely failed students for unsubmitted assignments, they instituted the ZAP (Zeros Aren’t Permitted) program during lunch — and they staffed it themselves for ninety minutes every day. The original six hundred F grades in their first quarter now average six. Other key initiatives included a student-led advisory program that has been manualized (Owens & Asher, 2008). They also created a year-long student-led orientation program for future RMS students to ensure a successful transition from elementary to middle school.
The school counselor created a truancy program in partnership with the county juvenile judge. When a relatively new language arts teacher (Kacie Heiken-Ploen) proposed a rather daring new course for at-risk girls, Peltzer (then the principal) was willing to support the innovation, believing that “At RMS it is okay to fail. Let’s try it, and if it doesn’t work we won’t do it again.” Aftershock, a language arts program focused on the real problems of these girls (such as eating disorders, suicide, abuse, cutting, etc.) was born from Peltzer’s enlightened leadership and Heiken-Ploen’s creativity and empathy for struggling girls. Each month a topic is studied through reading, discussion and journaling. This work leads to the production of a newsletter that goes out to the community to teach them about the problem, and so forth). The course promotes students’ positive sense of self and academic engagement. A male teacher now leads a boys’ version of the course, entitled ImpACT. As Peltzer explains, “We routinely take the kids in danger of dropping out, or much worse, and turn them into caring, prosocial leaders who succeed academically” (Berkowitz, Peltzer & Johnston, 2011, p. 2). In the 10 years between 2000 to 2010, discipline referrals at RMS dropped from three thousand to three hundred. The percentage of students meeting state standards has risen from under 7% to 71% in mathematics. In 2012, Peltzer concluded,

[T]he clientele of Ridgewood has not changed these past 10 years. Our families still struggle with extreme poverty and a section of our attendance area is still one of the highest crime areas in our county…. The difference is these kids, that 10 years ago were destroying the building and each other, now know they are valued and cared about, and now take on the leadership responsibility to create a culture and climate where they value each other, their school, their character, and their academic success. Most importantly, all this was done without ever changing our academic curriculum or our textbooks…. What we changed was how we met the social, emotional, and character development needs of our students. (p. 623)

Conclusion

Earlier in the paper we mentioned journalist Paul Tough’s inquiry into How Children Succeed: Grit, Curiosity, and the Hidden Power of Character, the best-selling book that resulted from his extensive investigation discussions with administrators, teachers, scientists, students and educational innovators in schools (good and bad) and research labs across the US. Tough came to the conclusion that what matters most to the future success of American children is not how much knowledge we can help them acquire but is instead that quality that most of us call ‘character.’ Nearly the same conclusion is reached by Amanda Ridley, another investigative journalist and author of The Smartest Kids in the World and How They Got That Way. In her extensive inquiry into the world’s highest achieving school systems for math and science – Finland, Korea, and Poland– Ridley wrote:

Over the next three decades, more and more studies showed that when it came to predicting which kids grew up to be thriving adults—who succeeded in life and in their jobs— cognitive abilities only went so far. Something else mattered
just as much, and sometimes more, to kids’ life chances. This other dark matter had more to do with attitude than the ability to solve a calculus problem. In one study of U.S. eighth graders, for example, the best predictor of academic performance was not the children’s IQ scores, but their self-discipline. Successful skill sets had more to do with motivation, empathy, self-control, and persistence. These were core habits, workhorse traits sometimes summed up by the old-fashioned word character (p.120).

This paper is a first attempt to examine the ways in which character education and the K-8 CCSS-M intersect to increase mathematics achievement. While we found sufficient research to demonstrate the value of character strength development in the achievement of mathematically proficient students, we found few of the specifically aligned curriculum materials and professional development resources that will be necessary if schools are going to benefit from the synergy of character education supported CCSS-M implementation. Our exploration revealed the existence of many excellent resources that need to be collected, adapted, aligned and made easily accessible.

In the following section we provide a glossary of additional character strengths/virtues, emphasizing their relationship to CCSS-M. Later, we illustrate the ways in which character education and CCSS-M can be integrated through a series of detailed lesson plans.

It is our hope that the new CCSS and comprehensive character education together will achieve our highest educational goal—to provide teachers and children with the tools they need to create their very best selves.
Glossary of Character Virtues in the Context of the CCSS-M

Performance Character
An underlying theme woven throughout all eight of the Common Core Standards for Mathematical Practice is the need for students to learn and exhibit what are variously referred to as habits of mind, non-cognitive skills, social and emotional competencies, character traits, and/or virtues. A number of the virtues students will be expected to demonstrate are directly related to performance. Performance Character can best be described as one’s mastery of and dedication to excellence in school, the workplace, and in other experiences (Lickona and Davidson, 2005). Virtues most often associated with performance character include civility, a positive attitude, self-discipline, diligence, and perseverance. Depending upon grade level, students should be expected to carry out performance tasks that reflect a number of positive character traits developed throughout the course of the curriculum. The following is a list of the virtues most notably developed throughout the implementation process of the math practice standards:

Civility: In his recent book, A Small Treatise on the Great Virtues, philosopher, Andre Comte-Sponville (2002) makes the claim that politeness is the first virtue as it enables all the others. Comte-Sponville explains, “Good manners precede and prepare the way for good deeds” (p. 10). As we refer to it, politeness is synonymous with courteous and civil behavior. Character education in the earliest elementary grades is largely about establishing shared and supportive classroom norms and routines that help students learn how to interact politely in the classroom and school context. Young children need opportunities to practice strategies for working effectively with others – taking turns, using ‘active’ listening skills, and sharing ideas and materials. Politeness, as such, comes before the other virtues in the sense that it serves as a foundation for the development of the relational dimensions of character that students need to achieve the rigorous collaboration and communication goals of the Common Core State Standards.

Character education provides teachers with strategies to help them teach, model, and expect polite behavior from their students. Classroom strategies such as pair-share, class meetings, and cross-age buddies provide opportunities for students to engage with the curriculum and practice effective interpersonal interaction strategies. Older students that have mastered basic civil discourse strategies will find it easier to work with partners or in small groups to continually improve their work product. Students in classes that have established safe and supportive norms will be more inclined to take risks, question conclusions, and share ideas. In this way civil schools and classrooms empower students to not only construct but to voice viable mathematical arguments and to effectively and helpfully critique the reasoning of others (Common Core Mathematical Practice Standard 3).

For more on civility in schools, see Restoring School Civility by Dr. Philip Vincent (2004).
**Self-discipline:** Self-discipline, sometimes referred to as self-regulation or self-control, may be best defined as the ability to manage oneself or one's conduct. Teachers are provided the opportunity to assist students with growth in self-discipline through application of the Common Core Mathematical Practice Standards. Younger students learn to regulate behaviors that easily take them off task from learning—sitting in their seat, reading quietly, and waiting their turn. Research on developing positive student behaviors demonstrates that programs that emphasize student self-discipline over external control through punitive responses to misbehavior show greater promise in improving school learning environments (Lapointe & Legault, 2004). Larry Nucci (2009) suggests that the development of self-discipline builds on four basic needs of children: autonomy, belonging, competence, and fairness (see “fairness” below for the authors’ use of the term).

Character education provides teachers with strategies to help them model and teach the benefits of self-discipline in their students. Classroom activities such as service learning provide opportunities for students to engage with other students and practice effective self-discipline techniques. Older students that have mastered self-discipline strategies will find it easier to work with others and to keep to the task at hand. Students in classes that feel safe and supportive will be more inclined to take risks, question conclusions, and share ideas. In such settings, students are able to gather more details towards solving a problem and be able to more readily "attend to precision" (Common Core Mathematical Practice 6).

For more information and examples on teaching students the art of self-discipline, see *Emotionally intelligent parenting: How to Raise a Self-disciplined, Responsible, Socially Skilled Kid* by Maurice Elias, Stephen Tobias, Brian Friedlander, and Daniel Goleman (1999).

**Perseverance:** Simply put, "students who are persistent do not give up easily" (Costa & Kallick, 2009, p. 78). In the math classroom, students show perseverance when they have to struggle a little bit to solve a problem. Research in the area of perseverance demonstrates that it is to the student's advantage to "grapple" in solving problems. Older students should not be expected to merely be passive recipients of knowledge; they should be empowered to develop habits from within that lead to future success (Harmin, 1994). Younger students should be given learning opportunities that have personal meaning to them so they are more willing to persist in arriving at a solution. Research is clear, the more students learn to persevere, the more they become focused on learning (Costa & Kallick, 2009).

Teachers have many stories available that demonstrate how perseverance leads to positive results. One such example comes from the product WD-40. The product name comes from “water displacement, test #40.” The first 39 attempts at developing the product did not displace the water correctly. It was on the 40th attempt that the creators of the product got the water displacement right. Teachers can also use reflective journaling with students to promote perseverance. Older students can reflect on an experience in which they were forced to "grapple" to come up with a solution and what that experience meant to them.
Younger students enjoy the benefits of grappling through the process of memorizing math facts, such as multiplication tables. Students who readily know such facts as multiplication and division tables will be able to more readily address complex math problems later. In this way students learn to persevere in solving a problem (Common Core Mathematical Practice Standard 1).

A great example of a math activity that requires perseverance would be a project based activity. Project-based learning activities usually involve four basic elements: (1) an extended time frame; (2) collaboration; (3) inquiry, investigation, and research; and finally, (4) the construction of an artifact or performance of a consequential task. Within the activity, students can showcase understanding through multiple check points along that way. Checkpoints allow students to become less frustrated, encouraging them to persevere along the way.

For good examples of project-based learning activities in math, see *PBL in the Elementary Grades*, by Hallermann, Larmer, and Mergendollar (2011).

**Diligence:** When one refers to someone as being diligent, they most often are referring to the care and attention expected of a person to complete a task. For some, this is best exemplified by the phrase, “measure twice, and cut once.” It is the idea that accomplishing the task alone is not enough; it must be done carefully and conscientiously. Lickona and Davidson (2005), argue that diligence is one of eight character assets needed for a flourishing life.

Teachers have multiple opportunities to teach students the importance of diligence in the math classroom. Older students are taught to be diligent through the effort required to solve a complex problem correctly and in detail. Younger students can manifest diligence in their ability to stay on the task at hand without distraction. In this sense, students see that diligence is the ability to put forth maximum effort for maximum results.

An excellent activity for teachers to use to teach diligence comes from Ron Berger’s (2003), “Austin’s Butterfly.” This activity affords teachers the opportunity to teach students how to work diligently to solve a problem over time. Students are given a chance to resolve an issue through multiple steps in which the same problem is worked over and over again to excellence. Students also learn to provide one another with ‘kind, helpful, and specific’ feedback that helps the teacher build a positive culture in the classroom.

Centuries ago, Samuel Johnson summarized the importance of diligence in his book of the same name, “What we hope to do with ease, we must first do with diligence”. For example, a good math activity for students to learn diligence is scale drawings and constructing 3-D models. Students come to understand the importance of being exact in their scale drawing so that when they construct the actual 3-D model, it is not flawed. If the student’s scale model is off, the walls of a house may not meet as designed. This is a good opportunity for
teachers to incorporate the use of technology in the classroom. Programs such as CAD (Computer Assisted Drawing) are excellent tools for scale modeling. In using an activity such as this, teachers help students learn to “model with mathematics” (Common Core Mathematical Practice 4), and to “use the appropriate tools strategically (Common Core Mathematical Practice 5).

Intellectual Character
It is in the interactions with thoughts and ideas that we find a natural connection with teaching character education traits within the new Common Core State Standards for Mathematics. Character Education Partnership’s (CEP) Eleven Principles of Effective Character Education (Beland, 2003) states, “Character has not only to do with how people interact with others (i.e., whether they treat others with fairness, respect, honesty, and kindness) but also how people interact with thoughts and ideas (i.e., whether they are curious about things, open to considering other viewpoints, and committed to pursuing truth and understanding) (vol. VI, p. 18). In this context, intellectual character virtues refer to traits necessary for right action and thinking (Paul & Elder, 2002).

Critical Thinking: The Critical Thinking Community (www.criticalthinking.org), refers to intellectual character as standards which must be applied to thinking whenever one is interested in checking the quality of reasoning about a problem, issue, or situation (see Common Core Mathematical Practice Standard 3). In their treatise, The Thinker’s Guide to the Nature and Functions of Critical and Creative Thinking, Paul and Elder (2008) define critical thinking in terms of the art of analyzing and evaluating thinking. The authors find that critical thinking is most often demonstrated through the character traits of discernment, wisdom, and judgment. Each virtue is a critical thinking skill in action. Discernment is best defined as the process of determining the value or quality of something, specifically. As a character virtue, a discerning student is considered to be a person of good judgment; especially so with regard to subject matter. Younger students demonstrate discernment through their ability to estimate a possible answer to a math problem. Older students demonstrate discernment through discussions involving moral dilemmas.

In light of this, judgment is best defined in terms of its application of discernment. Judgment is seen as the process of forming an opinion or evaluation by discerning and comparing. Similarly, wisdom is also best defined in terms of its application of discernment. Wisdom represents the ability to discern inner qualities and relationships and, coupled with just judgment, apply them to action. In its simplest form, wisdom is the connection of personal experiences to new learning. In this we see that the three key critical thinking skills, discernment, wisdom, and judgment, combine to form a strong basis for curriculum that teaches students to “make sense of problems” (Common Core Mathematical Practice Standard 1) and to “construct a viable argument” (Common Core Mathematical Practice Standard 3). In the math classroom, teachers will have ample opportunities within the
Common Core Practice and Content Standards framework to build students’ critical thinking skills.

**Understanding:** Included in Intellectual Character is the virtue of understanding. Most often, *understanding* refers to the ability of an individual to comprehend relationships between events or subjects. *Understanding* also can refer to one’s willingness to be open to another’s thoughts and experiences. That component of understanding is discussed below in open-mindedness. Character Education in the earliest elementary grades helps students develop these qualities (Streight, 2013). Teachers implementing character education strategies in the classroom will have opportunities to address student understanding both individually and collectively. Classroom activities involving moral dilemmas afford teachers this opportunity. Through the use of moral discussion, older students are given opportunities to take into account the ethical components of decision making in “real world problems” (Common Core Mathematical Practice Standard 2).

An excellent tool for teaching both older and younger students understanding is the use of cross-age buddy training. For example, in a cross-age buddy training activity in which fifth graders are helping second graders learn a new math concept, the older students will need to have a sense of understanding of the younger student’s limited problem solving skills in math. The older students will understand that their skill set and knowledge is at a higher level than the younger students. A fifth grade student helping a second grade buddy solve a money problem where dollars are added to cents will come to an understanding that the younger buddy does not know algorithms for adding three digit and two digit numbers. The older buddy understands that the younger buddy will need manipulatives in solving such problems.

**Precision:** It has been suggested that *precision* is one of the most important intellectual virtues for critical thinking (Paul & Elder, 2002). Precision refers to the degree of accuracy to which an operation is performed (Paul & Elder, 2002). In other terms, precision refers to the degree to which one chooses to be accurate in their effort. Teachers have the opportunity to address student accuracy through classroom activities involving the use of class discussion or presentation. For example, older students can be given the opportunity to demonstrate precision through graphing activities in which data has to be presented in a manner that is not a misrepresentation of the facts. Younger students can use role playing to learn precision. For example, students can serve in the roles of consumer and sales clerk wherein one must give the appropriate change back to another on a purchase. In the process of doing so, younger students will come to understand numbers and how they apply to everyday situations (Common Core Mathematical Practice Standard 2).


**Open-Mindedness:** *Open-mindedness* is the quality of being willing to seek new ideas, and being receptive to ideas that are contrary to one’s current beliefs. Establishing a classroom culture of civil discourse, curiosity, honesty, respect and empathy promotes the habit of open-mindedness. Teachers model open-mindedness for students when they demonstrate
curiosity about a topic, reflect on it aloud, structure class activities around inquiry and discovery, and admit to something that they don’t know. Class meetings, moral dilemma discussions, and think-pair-share activities are all strategies that teachers can use to allow children to listen to the perspective of others. Consequently, students may change their own thinking. For example, kindergartners from different cultures may come to school counting on their fingers in different ways: some start at the thumb, some the little finger, some raise the finger to count, and some lower the finger to count. Even very young children can share and appreciate the cultural differences in this practice that they bring from their homes. The establishment of norms of behavior that respect difference, at all grade levels, support the habit of open-mindedness. In this way, students will gain confidence in their strategies, be comfortable developing their own “viable arguments”, and “critiquing the reasoning of others” (Common Core Mathematical Practice Standard 3). Teachers may also want to use classroom activities where students are given opportunities to respond to student presentations in a constructive manner (see, for example, Ron Berger’s “Austin’s Butterfly” project noted earlier). Younger students can feel secure knowing that their efforts are not “put down” or “judged” by their classmates.

Civic Character
“Civic character is the character of a good citizen” (Seider, 2012, p. 3). Civic virtues, then, are defined as those activities that cultivate habits of personal living that are deemed important for the success of democratic communities, such as being law abiding, tolerating the views of others and having a strong commitment to participating in local, regional, and national policy/governance events.

Cooperation: Cooperation is best represented as the extent to which a group of persons work together for a common good. Opportunities abound for students to practice cooperation within various activities available to teachers. Older students can work collaboratively in small groups to solve a multistep problem aimed at real world application. Younger students can work in pairs or with an older buddy to learn processes for solving addition and subtraction problems. Research has shown that cooperative learning is an effective approach for including all types of students in classroom group work and promoting peer acceptance. With K-2 students, an example of a possible cooperative learning activity for teaching estimation is as follows:

1. Show students a jar of items and let them estimate the number in the jar.
2. Divide students into groups and let them brainstorm ways to get better estimations.
3. Provide students with bags of items similar to those in the jar.
4. Let students group them in different amounts and then decide if they want to change their estimates.

At the end of the class, the teacher can divulge the number of items in the jar and children can share their estimation strategies. This is an example of how cooperation can be applied to the math content standard of numbers and operations.
For more resources on cooperative math learning activities, see *Cooperative Learning in the Classroom*, by Johnson, Johnson, and Holubek (1994).

**Fairness:** Fairness is represented by the idea of one’s ability to show impartiality, or even-handedness. Teachers model fairness by calling on all students equally, assigning roles and responsibilities in a just manner, and being objective in assigning consequences.

Teachers can engage students on the topic of fairness through work in group settings. Older students come to understand fairness through teamwork when each person fulfills their part in solving the assigned problem. (In many cases, students working in a group receive the same grade. This can be an area for discussion on fairness.) Younger students learn fairness through self-reflection questions in which they are asked to put themselves in another student's shoes. This is a great place to discuss students with disabilities and how we treat them. In the math classroom, students can discuss the concept of fairness through money problems or data and measurement scenarios. For example, teachers could lead a discussion on the fairness of the Electoral College system used for electing the President of the United States. Is it fair that a candidate can lose the majority vote of the people and still be elected to the office of President based on the Electoral College system?

In his article, *Mathematics and Social Justice in Grade 1: How Children Understand Inequality and Represent It*, former elementary teacher M. Shaun Murphy (2009) demonstrates how teachers can address issues of fairness with elementary students during their work with number representation, operations, and complements. Teachers will also find Eric Gutstein’s (2006) book, *Reading and Writing the World with Mathematics: Toward a Pedagogy for Social Justice* to be an excellent resource.

**Moral Character**

Moral character refers to traits that are relational and ethical in nature (Lickona and Davidson, 2005). Specifically, moral character concerns how one treats others in interpersonal and social matters. The virtue words used here include empathy, honesty, respect, and responsibility.

**Empathy:** Empathy is most often demonstrated through the actions of being aware of, or being sensitive to, the feelings, thoughts, or experience of another person. Common Core Mathematical Practice 3 requires students to “critique the reasoning of others.” Teachers can elicit empathy when they ask students “How would you feel if your classmates were not willing to listen to your solution if it differs from their solution?”

**Honesty:** Thomas Jefferson considered honesty to be the “first chapter in the book of wisdom.” He believed that children develop a sense of honesty when very young. However, much of the research on honesty shows that a child’s perceptions of honesty vary with age and context. Sadly, academic dishonesty appears to be an increasing issue in K-12 and higher education. Codes of honor have existed (and been famously broken) for many years. If we consider honesty in terms of "truthfulness" we see its application within the practice
standards, specifically when beings asked to “construct viable arguments” and “critique the reasoning of others” (Common Core Mathematical Practice Standard 3) and again when asked to “communicate precisely” (Common Core Mathematical Practice Standard 6).

Teachers behaviorally anchor the concept of honesty in developmentally appropriate terms, such as, “keep your eyes on your own paper”, “do your homework by yourself”, and “give credit to your source of information.” Teachers have multiple opportunities to instill in students the virtue of honesty. Older students can be assigned graphing activities as a means to discuss honest portrayal of data. Younger students can be taught to share openly and honestly how they came to a solution of a problem. As demonstrated above, teachers always have an opportunity to address the concept of honesty whenever giving an exam.

Respect: Respect has been called “the single most powerful ingredient in nourishing relationships and creating a just society” (Lawrence-Lightfoot, 2000, p. 13). Jackie Robinson once said, “I am not concerned with your liking or disliking me ... All I ask is that you respect me as a human being.” In that manner, a respectful person is one who respects the rights and dignity of all persons. Respect also includes the right of conscience to disagree appropriately with another’s beliefs (Lickona and Davidson, 2005).

Teachers can work with students on actions that show respect in a number of ways. For example, older students can be taught to show respect when they listen objectively to the arguments of others. This can be done during classroom presentations and reflects a positive ability to “critique the reasoning of others” (Common Core Mathematical Practice Standards 3). Younger students can be taught to show respect by following the directions of the teacher on the first request.

For more ideas on teaching students how to act respectfully in the classroom setting, refer to Lesson #5 in Lessons Learned from the Classroom: 20 Things Good Teachers Do, by Hal Urban (2008).

Responsibility: Simply put, responsibility refers to the act of showing and encouraging a personal commitment to a task. Clifton Taulbert (2006), in his book Eight Habits of the Heart for Educators, states that students demonstrate responsibility doing something for the benefit of others and doing it well. He further argues that responsibility is not about being skilled; it is about commitment and consistency.

Teachers have multiple opportunities to teach responsibility in the classroom. For example, teachers can give older students an opportunity to write about their goals and regularly check their progress toward them. Once the goals have been met, teachers can work with students on setting higher targets. Younger students demonstrate responsibility by being on time to class, submitting assignments on time, and sharing school-work with family members.

Service learning activities also work well in teaching students about responsibility. For an example of a service learning project for mathematics, see “Service in Bloom” in Character Education Connections for School, Home and Community: A Guide for Integrating Character Education 2002 pp. 25-28)

Communication
The authors propose that *good communication skills* should be considered a viable and necessary performance virtue to nurture in students. Although not generally considered to be a virtue, the ability to communicate effectively is an important trait for all students to be successful within the expectations of the Common Core State Standards. For example, Mathematical Practice Standard 6 refers to the need for students to communicate precisely and correctly (NGA/CCSSO, 2010, p.7). Costas and Kallick (2009) demonstrate the importance of teachers helping students learn to communicate with clarity and precision because ‘students’ and adults’ oral language often is filled with omissions, generalizations, and vagueness (p. 52). Research shows that when people use *good communication skills*, both the person speaking and person receiving the information benefit.

Teachers have ample opportunities to work with students on their communication skills within character education initiatives. As with *honesty*, teachers can use any number of group type activities or classroom presentations to give students the opportunity to work on their communication skills. In these types of settings, older students can be taught to focus on listening skills. Younger students can be taught the importance of details when telling others of an event. Teachers can use instruction of *good communication skills* to reiterate the importance of *honesty.*

Of course, not too long ago, communication skills could only be developed in the classroom through verbal conversation or paper and pencil activities. Today, with the advancement of the personal computers and other devices, the opportunity for, and importance of, teaching communication skills through technology abound. For example, students can be encouraged to use Power Point or Prezi during a classroom presentation to assist in the detail of the message being given. In classrooms where personal computers are available for student use, math games can be opened on-line for students to work on listening skills while having fun in solving math problems. Older students can even be taught how to communicate using email or chat with students from a sister classroom overseas or in another state.
Glossary of Instructional Strategies

Class Meeting: Class Meetings are a method that provides teachers and students with opportunities to interact with each other in a pro-social structure and create opportunities for students to exercise their choice and voice. Ground rules for positive communication enable students to create a welcoming community that encourages all of them to participate and none to dominate. The group uses consensus and voting to make decisions that affect classroom climate, academics and events. Every member is empowered to identify problems and present them to the group for consideration. The Developmental Studies Center (1996) suggests having the following three types of meetings: (1) planning and decision-making, (2) check-in, and (3) problem-solving and consciousness raising meetings. The planning and decision-making meeting introduces the idea of the classroom as a community, builds on children's intrinsic motivation to learn, and allows the teacher to gain some insight on some of the students' personalities. The check-in meeting should occur at least a couple of times during the year and allows the students to evaluate their behavior against the goals they set for themselves at the beginning of the year. The problem-solving and consciousness raising meetings provide more of a blueprint for how to use the class meeting to address sensitive issues.

Cross-Age Buddies: This involves pairing older and younger students for activities that provide for cross-age socialization and academic goals. Ideally, three grade levels should separate older and younger buddies.

Moral Dilemma Discussion: This technique presents students with a dilemma, a scenario that pits two or more moral principles requiring a mutually exclusive choice. If there is a clear “right” and “wrong” answer, the scenario is not a dilemma, but simply a choice. The purpose of presenting these scenarios is to create opportunities for students to explain their thinking about the costs and benefits of each choice. The ensuing discussion, in an atmosphere of mutual respect and acceptance, allows students to experience the logic and thinking of others as they grapple with complex ideas. According to Kohlberg (1983) there are three main ways that teachers can facilitate students’ learning as it relates to moral development: (1) heightening moral awareness, (2) developing more adequate moral reasoning, and (3) affecting moral behavior. Increasing students’ moral behavior includes recognizing the rights and claims of others, as well as one's responsibilities and obligations to them. The development of moral reasoning is influenced by having discussions that involve critical thinking about moral topics, while affecting moral behavior is slightly more complicated and requires teachers to examine the moral components of the behavior.

Fishbowl: Fishbowl activities are structured opportunities for one group to speak and another group to only observe, and not speak. This forces close attention to the
perspectives of the group that is speaking. The speaking group sits in a circle while the observers stand or sit behind them and listen and learn.

**Student Critique:** A technique developed by Ron Berger, (2003) that encourages students to use multiple attempts in their work to foster an ethic of excellence and an appreciation of craftsmanship. Reviewing can be done in partnerships, in small groups, or as a class. Partner reviews can often be the most productive, as students can devote substantial attention to each other’s work. Also, the privacy of a partner review can be especially helpful in the very early stages of a project, when students simply want to bounce ideas off another person or feel tentative about their work.

**Journaling:** Journaling notebooks provide many opportunities for students to use free writing as a tool for learning. Students may benefit greatly from exploring their thinking and reflections through writing. They clarify their ideas, identify confusing points, integrate new information with their background knowledge, and deepen their understanding. Teachers can use journals before an assignment, during the assignment, or after the assignment in any subject area. Response notebook entries can be as simple or complex as the teacher chooses. Open-ended questions that have no single correct answer also provide students with numerous possibilities for critical thinking about the assignment.

**Reflection:** Reflection is a metacognitive function of reviewing one’s thinking for clarity and understanding. It may involve journaling or verbalization and sharing with others. In Cress, Collier, and Reitenauer (2005), four characteristics of successful reflection are identified: (1) continuous, (2) challenging, (3) connected, and (4) contextualized. Reflection must take place continuously before, during, and after the completion of service learning, for example to be fully useful. A challenging reflection involves pushing ourselves out of our comfort zones to make new connections between concepts and to think in new ways. A connected reflection can serve as a bridge between the experience and the discipline-based academic knowledge. Lastly, a contextualized reflection is framed in a manner that is appropriate for the context in which the activity takes place.

**Think-Pair-Share:** The Think-Pair-Share strategy is designed to provide students with “food for thought” on a given topic by enabling them to formulate individual ideas, and share these ideas with another student. It is a learning strategy that encourages classroom participation. This method allows students to discuss their conjectures about a topic with another student in a manner that minimizes the risks of public classroom recitation. Students reflect on their answer to a given prompt before discussing their thoughts with another student. The other student does the same, and one of them may be asked to report their mutual thoughts.

**Homeside Activities:** Family and child activities can link what is learned in school to the home, and may foster communication by accessing family experiences and perspectives.
**Public Presentation:** An instructional technique that results in a presentation of the material mastered by the student as the outcome of a learning unit. Students may present to their peers or to adults.

**School-wide Character Education:** An approach to character education that includes the entire school population in a planned effort to promote good character in students. Types of school-wide strategies include: morning announcements, assemblies, school newsletters, “character” days or special events. Strategic cross-age team building activities also build relationships and benefit older and younger students.

**Service-Learning:** Service-learning occurs when students engage in community service activities with intentional academic learning goals and opportunities for reflection that connect to their academic disciplines (Cress et al., 2005). If school students collect trash out of an urban streambed, they are providing a valued service to the community as volunteers. When school students collect trash from the side of the highway, it is community service. If they analyze the problem of litter and graph the amount of money per state that is spent on litter removal, that is service learning.

**Family Fund of Knowledge:** The idea of a fund captures the collective wisdom and prior knowledge contained in all the members of a student’s family unit. Students may be exposed to varying funds of knowledge about topics at home, but all can convey their school learning to home and their home learning to school.

**Civil Discourse:** Civil discourse refers to civil or polite conversation or dialogue. Having the ability to converse with others in a civil manner who may hold opposing views or have different priorities fosters the common good. A prerequisite for sustaining democratic societies is participation from all members, regardless of opposing views. Even when opposing opinions create dissent, civil discourse permits an exchange of viewpoints that does not allow positional power to dominate the conversation. Discussion is one of the best ways to nurture growth because it is premised on the idea that only through collaboration and cooperation with others can students be exposed to new points of view. The exposure increases understanding and renews their sense of motivation to continue learning (Brookfield, 2005).
References


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Appendix B
K-8 ILLUSTRATIVE LESSON BRIEFS

Lesson: Everyone Gets To Play
Grade Level: 1
Practice Standard 4: Model With Mathematics

First grade students work in pairs to organize hypothetical kickball teams that accommodate scenarios involving various and changing numbers of players. Students will create a diagram to analyze problem situations and then work collaboratively to reach a solution. By using the playground standard game of kickball as the setting, students have the opportunity to solve problems that arise in everyday life and society. This involves using addition and subtraction to solve various scenarios that are presented in word problems. These problems require students to: 1) add, 2) subtract, 3) combine, 4) separate, 5) and compare, with unknowns in all positions. This will require them to use objects, drawings, and equations with a symbol for the unknown number that represents the problem. They must use symbols (Xs, Os) to represent players and those who wish to be players to simplify a complicated situation and manipulate symbols to find the answer. As a last step, students present their drawings to each other in a class meeting. As each pair goes around the circle, they should describe their process while the rest of the group listens to assess whether the solutions make sense. Additionally, students practice respecting others by making one statement about the strength or ability of his/her partner, offering affirmations, and compiling a list of personal attributes that students can reference in future group activities. The teacher may also pose questions that engage students' metacognitive abilities as they consider how the solutions of others might improve their own. A further extension can be a discussion of alternative scenarios regarding the kickball field or team members.

Lesson: What Does It Stand For?
Grade Level: 2
Practice Standard 7: Look For and Make Use of Structure.

In this budding activity for second and fifth graders, the fifth graders solidify their own understanding of place value while teaching it to their younger buddies. The concrete models (“manipulatives”) that the fifth graders create become the method of demonstrating how single objects can be composed of several objects to the second graders. The younger students will observe the patterns and structure of ones, tens and hundreds through the use of the materials created by their buddies. Through working
together to solve addition problems that involve place value, the older buddy will scaffold learning for the younger students. Older students will also receive feedback from younger students who participate in the “Fishbowl”.

**Lesson: A Sweet Decision**

**Grade Level:** 3

**Practice Standard 2:** Reason Abstractly and Quantitatively

In this cross-age buddy lesson, a third and fifth grade teacher partner with the cafeteria staff to teach third grade students how to contextualize and decontextualize the representation of the partition of wholes into fractional parts. Older buddies and the cafeteria staff will help third graders use common kitchen tools to measure, mix, and bake ingredients to make brownies that can be shared between the classes, grades, or throughout the whole school. Using commercial size pans allows the students to estimate how many brownies the pans might yield divided different ways, thus attending to the meaning of quantities and comparing fractions by reasoning about their size. As students reflect upon the challenges of feeding more students than just themselves, the teacher and cafeteria staff pose questions about how planned portion sizes can be altered to create more portions by reducing individual portion size. The classes collaboratively explore these concepts with each other while older buddies guide the recording of the findings/decisions in the third grade students’ reflective journals.

**Lesson: Where Did the Dollar Go?**

**Grade Level:** 4

**Practice Standard 1:** Make Sense of Problems and Persevere in Solving Them.

In this fourth grade word problem students solve the mystery of seemingly missing money. Students practice their critical thinking skills to make a conjecture and plan a solution pathway. Students consider the relevant and irrelevant information given in the problem to solve it. Part of evaluating the given information requires students to apply the four operations, and represent them by using equations that stand for the unknown quantity. In addition to applying operations, they will work with a partner to thoroughly evaluate potential strategies and solutions. A metacognitive reflection is another activity that assists students in making a conjecture and planning a solution pathway. The problem incorporates a misconception, necessitating that students grapple with the notion of a procedural error. Students must persevere through this problem that provides the opportunity to make a mistake, recover, and return to the problem from a different
perspective to solve it. Because there are multiple ways to represent the solution, students can compare answers and come to agreement. This type of reflection involves asking students to consider their approach to the problem. Lastly, the ethical discussion presents the students with an opportunity to define honesty in a real world context while discussing the potential damaging effects of dishonest actions.

**Lesson: A Million Pennies**  
**Grade Level:** 5  
**Practice Standard 8:** Look For and Express Regularity In Repeated Reasoning

A school-community activity led by the fifth grade takes on the substantive service-learning project of collecting one million pennies over the course of the school year. This whole school activity, adapted from Character Connections, tasks fifth graders and their adult partners to: 1) develop a strategy, 2) set incremental goals, 3) predict likely problems and contingency plans, 4) design procedures, and 5) assign roles and schedules. In addition to these tasks, the students are responsible for maintaining oversight of the process which requires attending to details and mathematical precision. All students will participate in nominating ideas and voting on the way(s) the funds will be used. Fifth graders will also track the collection for reporting to the community and use line plots to display a data set of measurements that interact with the data set in various ways. As the year progresses, students must reconcile the accounting and evaluate the reasonableness of their intermediate results.

**Lesson: A Taxing Assignment**  
**Grade Level:** 6  
**Practice Standard 6:** Attend To Precision

Sixth grade students consider the difference between fairness and equity in the various forms of government taxation. This activity requires students to use clear definitions in discussions with others and in their own reasoning as they find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. This lesson uses taxation as the context for students to calculate accurately and express numerical answers with precision. The ubiquitous issue of fairness is a compelling one for students in middle school, and provides an opportunity for co-curricular connections with the Social Studies curriculum. Students use their prior knowledge, as well as new research and gathered information, along with sense of fairness to develop, and they argue their stance on whether a flat tax rate or a graduated tax rate represents the greatest good.
Lesson: Growing For Others
Grade Level: 7
Practice Standard 5: Use Appropriate Tools Strategically
In this project, students work in teams to select the appropriate tools to make sound decisions regarding the need for pencil and paper, graph paper, rulers, concrete models and protractors to design the plans for a raised-bed schoolyard garden, within a prescribed constraint of space that represents specified geometric shapes. Students use collaborative strategies of goal and purpose setting, role definition, and project planning to complete the plan for their assigned raised bed the garden shape. Students present their designs to other teams/classes and give and receive feedback, which may influence some revisions. This activity has potential for an interdisciplinary extension with science if gardens are actually constructed from the models.

Lesson: What’s A Fair Share? Grade Level: 8
Practice Standard 3: Construct A Viable Argument and Critique the Reasoning of Others
Eighth graders are tasked with planning/budgeting a school trip requiring fundraising. Students are challenged by the fact individuals attending have access to different resources. This problem requires students to: 1) write an equation for calculating total cost, 2) graph possible solutions for total cost, 3) assess the reasonableness of possible solutions, and 4) employ estimation strategies. These steps will prepare them to make conjectures and build logical arguments that allow them to explore the truth of their conjectures. For example, their arguments can be used to evaluate concepts of “fairness,” “equality,” “equity,” and “cost/benefit”. The scenario may initially appear rather simple, however, as more data is presented; students will notice the growing complexity and require them to engage in a multi-step mathematical problem. The mathematical problem will also rely on qualitative elements that involve justifying and explaining their conclusions to others.