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Introduction

The purpose of this booklet is to provide classroom teachers and administrators with examples and strategies to implement the new Common Core State Standards (CCSS) for Mathematics for advanced learners at all stages of development in K–12 schools. One aspect of fulfilling that purpose is to clarify what advanced opportunities look like for such learners from primary through secondary grade levels. Specifically, how is effective differentiation designed for top learners in mathematics? How can educators provide the appropriate level of rigor and relevance within the new standards as they translate them into experiences for gifted learners? How can educators provide creative and innovative opportunities to learn that will nurture the thinking, reasoning, problem solving, passion, and inventiveness of our best students in mathematics?

In this booklet, trajectories for talent development in mathematics will be described. These progressions lend vision to the work of teachers as they deliver classroom instruction at one level and prepare students for succeeding levels in the journey toward self-fulfillment and the real world of science, technology, engineering, and mathematics (STEM) professions. What are the skills, habits of mind, and attitudes toward learning needed to reach high levels of competency and creative production in mathematics fields? How does the pathway from novice to expert differ among promising learners?

The booklet also includes multiple resources in the appendix material to support educators in developing and modifying materials for students who are advanced in mathematics. In addition to including a list of definitions of the key terms used in the booklet (Appendix A), we have included a research base of best practices in gifted education (Appendix B), annotated references to key publications and websites focused on mathematical creativity and giftedness (Appendix C), and a list of publications addressing mathematics and K–12 students (Appendix D).

The booklet is also based on a set of underlying assumptions about the constructs of giftedness and talent development that underpin the thinking that spawned this work. These assumptions are:

- Giftedness is developed over time through the interaction of potential with nurturing environmental conditions. The process is developmental, dynamic, and malleable.
- Many learners show preferences for particular subject matter early and continue to select learning opportunities that match their predispositions if they are provided with opportunities to do so. For many children, especially those in poverty, schools are the primary source for relevant opportunities to develop domain-specific potential, although markers of talent development also emerge from work done outside of school in co-curricular or extracurricular contexts.
- Aptitudes and interests may also emerge as a result of exposure to high-level, engaging, and challenging activities. Teachers should consider using advanced learning activities and techniques as a stimulus for all learners.
- Intellectual, cultural, and learning diversity among learners may account for different rates of learning, different areas of aptitude, different cognitive styles, and different

> experiential backgrounds. Working with such diversity in the classroom requires teachers to differentiate and customize curriculum and instruction, always working to provide an optimal match between the learner and her readiness to encounter the next level of challenge.

Users of this booklet should note that the ideas contained herein are not intended to apply exclusively to identified gifted students; they also apply to students with potential in mathematics, as they also might develop motivation and readiness to learn within the domain of mathematics.

Finally, it is our hope that this booklet provides a roadmap for meaningful national, state, and local educational reform that elevates learning in mathematics to higher levels of passion, proficiency, and creativity for gifted—and, indeed, all—learners.

The Common Core State Standards

The Common Core State Standards for Mathematics are K–12 standards that illustrate the curriculum emphases needed for students to develop the skills and concepts required for the 21st century. Two sets of standards are described: Standards for Mathematical Practice and Standards for Mathematical Content. Adopted by 45 states to date, the CCSS are organized into key content domains and articulated across all years of schooling and, when adopted, replace the existing state content standards. The initiative has been state-based and coordinated by the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO). Designed by teachers, administrators, and content experts, the CCSS are intended to prepare K–12 students for college and the workplace.

The new CCSS are evidence-based, aligned with expectations for success in college and the workplace, and informed by the successes and failures of the current standards and international competition demands. The new standards stress rigor, depth, clarity, and coherence, drawing from national and international studies such as the National Assessment of Educational Progress (NAEP) Frameworks in Mathematics (NAEP, 2011) and the Trends in International Mathematics and Science Study (TIMSS) report in mathematics (National Center for Education Statistics [NCES], 2007). They provide a framework for curriculum development work. States are working within and across local districts to design relevant curriculum, align current practice to the new standards, and develop resources that support teaching and learning.

Rationale for the Work

The adoption of the Common Core State Standards in almost every state is cause for gifted education as a field to reflect on its role in supporting gifted and high-potential learners appropriately in the content areas. The field of gifted education has not always differentiated systematically in the core domains of learning, but rather has focused on interdisciplinary concepts, higher level skills, and problem solving, typically across domains. With the new CCSS and their national focus, it becomes critical to show how to differentiate for gifted learners within a set of standards that are reasonably rigorous in each subject area.

Some advocates of the new CCSS have suggested that the standards are already at such a high level that no specialized services and differentiation are needed for gifted students. Although the standards are strong, they are not sufficiently advanced to accommodate the needs of most learners who are gifted in mathematics. As the CCSS developers have noted, some students will traverse the standards before the end of high school (NGA & CCSSO, 2010b, p. 80), which will require educators to provide advanced content for them. In addition to the need for accelerative methods, there is also a need to enrich and extend the standards by ensuring that there are open-ended opportunities to meet the standards through multiple pathways; more complex, creative, and innovative thinking applications; and real-world problem-solving contexts. This requires a deliberate strategy among gifted educators to ensure that the CCSS are translated in a way that allows for differentiated practices to be employed with gifted and high-potential students.

As with all standards, new assessments will likely drive the instructional process. As a field, educators of the gifted must be aware of the need to differentiate assessments that align with the CCSS and content as well. Gifted learners will need to be assessed through performance-based and portfolio techniques that are based on higher level learning outcomes and that often vary from the more traditional assessments the CCSS may employ.

Although the new CCSS appear to be a positive movement for all of education, it is important to be mindful of the ongoing need to differentiate appropriately for top learners. As a field, it is also critical to agree on the need to align with this work so gifted education voices are at the table as the CCSS become one important basis, along with the newly revised InTASC Model Teacher Standards (CCSSO, 2011), for elevating teacher quality and student learning nationwide.

The Common Core State Standards for Mathematics have significant implications for teaching mathematics in grades K–12. Our collective future lies in the individual development of students with mathematical promise, students who will fulfill their own potential and also provide leadership for others. This individualized developmental approach includes students who traditionally have been identified as gifted, talented, advanced, or precocious in mathematics, as well as those students of promise who may have been excluded from the rich opportunities that might accompany this recognition. As with all students, these students with special needs deserve a learning environment that supports them in the fulfillment of their personal potential.

Alignment to 21st Century Skills

This booklet includes a major emphasis on key 21st century skills (Partnership for 21st Century Skills, n.d.) in overall orientation as well as in activities and assessments employed in the examples. Several of these skill sets overlap with the differentiation emphases discussed below in relation to the gifted standards. The skills receiving major emphases include:

- *Collaboration:* Students are encouraged to work in dyads and small groups of four to carry out many activities and projects, to pose and solve problems, and to plan presentations.
- *Communication:* Students are encouraged to develop communication skills in written, oral, visual, and technological modes in a balanced format within each unit of study.
- *Critical thinking:* Students are provided with models of critical thought that are incorporated into classroom activities, questions, and assignments.
- *Creative thinking:* Students are provided with models of creative thinking that develop skills that support innovative thinking and problem posing and solving.

- *Problem solving:* Students are engaged in real-world problem solving in each unit of study and learn the processes involved in such work.
- *Technology literacy:* Students use technology in multiple forms and formats as a tool in solving problems and to create generative products.
- *Information media literacy:* Students use multimedia to express ideas, research results, explore real-world problems, and evaluate information presented in media (graphs and diagrams) for mathematical accuracy.
- *Social skills:* Students work in small groups and develop the tools of collaborating, communicating, and working effectively with others on a common set of tasks.