Multicultural Pathways to STEM
Engaging Young Gifted Black Boys Using the Color-Coded Bloom-Banks Matrix
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“Did You Put Magic in There or Something?”

Jerold, an African American boy, is a rambunctious, imaginative, and intelligent first grader who asks a lot of questions and always has an elaborate explanation full of abstract, layered details to share during science class. He is a critical thinker who is being screened for gifted education services. Jerold’s almost all White classmates are captivated by his questions—questions they had not considered. He works well with his classmates and enjoys science experiments, but gets frustrated when his teacher (Ms. Flower) does not understand what he thinks is happening scientifically. When Ms. Flower, a White female teacher, invites students to the science area of the classroom, Jerold is the first one to arrive with his mind racing, hand raised, and ready to participate. For 2 weeks, these first graders have been investigating plant growth and development using bulbs. As part of their experiment, students were told that they would force bulbs into bloom. Ms. Flower also told them that part of being a scientist is observing and documenting the changes that take place over time using “scientific language.” To carry out this experiment, she instructed Jerold and his classmates to pick up the following materials from the science center: one clear cup for planting, a few marbles, stones or pebbles, a small bottle of water, and a bulb. Assigned to science cooperative learning groups, Jerold and his partner Lilly gathered their materials and returned to their desks. Eager to get started, Jerold filled the cup with marbles, Lilly placed the bulb on top with the root side down, and then Jerold poured in the water until it is just barely covered the bottom of the bulb. Together, they held both sides of the cup containing their bulb and walked over to place it on the sunny window ledge of their classroom. Fast-forward 2 weeks. Ms. Flowers walks around to talk with groups of children about their observations and documented changes to their bulbs. She arrives at the window ledge where Jerold and Lilly placed their bulb and invites them to join her to discuss their observations. With surprised looks on their faces, both children are amazed by the growth of their bulb. Before Ms. Flower can ask a question, Jerold, with his usual contemplative look, interjects a question: “Did you put magic in there or something?”

Too often, Black children, especially Black boys, quickly lose interest in Science, Technology, Engineering, and Math (STEM) when their ideas are not seriously taken up by teachers because their sense making may be unfamiliar to teachers. This lack of familiarity can serve to downplay and minimize the reasoning and sense making (e.g., experiences, knowledge, beliefs) resources that Black boys use as they engage in STEM learning. When this happens, Black boys disengage, and may resort to misbehaving, which contributes to not being referred to or screened for gifted education; but it can result in suspensions, as well as underachievement and achievement gaps. For these reasons, it is important to take a closer look at early childhood education and STEM as they relate to Black boys in the early grades so that serious consideration is devoted to creating viable pathways to STEM in the early childhood classroom. Like Jerold and the STEM assignment

Gifted black boys must experience meaning and success on a level that meets their individual needs and interests in STEM, while affirming their self-identities and promoting agency.”

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above, more Black boys can be “budding” scientists but they will not bloom if unnurtured.

**STEM Learning in Early Childhood Education**

Although young children (ages 3-8 years) have the capacity to engage in STEM investigations, schools and educators consistently underestimate their abilities (National Research Council, 2007). Low expectations for STEM outcomes are further complicated and hindered by stereotypes and assumptions about STEM learning aptitudes assigned to young children representing various nondominant groups, such as African American boys. For instance, in STEM research, Rosebery and Warren (2001) explained,

> The talk of an African American child who conveys his ideas about science in the form of a story is often seen by educators who operate with White majority, “mainstream” perspectives as somehow less “scientific” or “mathematical” than the talk of a White child who conveys her ideas in objective, propositional language. (p. 4)

As a result, early childhood and primary grade teachers often miss daily opportunities to engage all young children in STEM activities that promote scientific thinking, mathematical reasoning, and engineering design in general (Counsell & Wright, 2016).

In fact, the windows of early learning and development long believed to exist for language acquisition and mathematical concepts have been extended to scientific thinking. Early mathematical thinking contributes to later math and reading achievement (Begley, 1996; Shonkoff & Phillips, 2000; Wright, Counsell, Goings, Freeman, & Peat, 2016), and spatial ability contributes significantly to STEM expertise and achievement (Gersmehl & Gersmehl, 2007). The learning and developmental benefits of science experiences with young children are evident (Eshach & Fried, 2005). However, teachers and researchers routinely misunderstand and fail to capitalize on Black children’s “ways with words” (Heath, 1983) in general and in the STEM classroom in particular (Wright et al., 2016). These unintentional misunderstandings arise in part because teachers have not yet learned to recognize, appreciate, and integrate the diverse sense-making practices that children underserved/underrepresented in STEM education deploy as they work at understanding scientific or mathematical ideas and practices. Moreover, these misunderstandings are increased when it comes to understanding the out-of-school ways of talking and knowing as they relate to STEM (Wright et al., 2016). This brings us to two important questions:

a. What opportunities are missed when educators do not know how to see the strengths in the talk and reasoning of Black boys in general and those who are gifted?

b. How do we build on the out-of-school experiences that Black boys in early childhood deploy as having real value in the STEM classroom?

In this article, we build on the story of Jerold, a first grader who is passionate about science and advanced in STEM learning. We want to keep Black boys interested in, curious about, and engaged in STEM. Such nurturing and support must be intentional. The authors use the Color-Coded Bloom-Banks Matrix (Trotman Scott, 2014) that is revised from Ford (2011) to encourage and motivate Jerold and other Black boys to find and/or keep a passion for STEM subjects. The sample matrix provides guidance for teachers to develop a rigorous and culturally relevant STEM curriculum. It is one approach and/or strategy for improving achievement, behavior, engagement, and STEM skills by challenging and engaging gifted Black boys.

There are legitimate concerns about the need to make the curriculum culturally responsive and relevant for gifted Black boys and those with high potential. This is particularly important in the case of STEM teaching and learning in which limited modes of thinking or kinds of meaning are valued in the classroom. As a result, gifted Black boys and other children from historically underserved communities are disadvantaged by the curriculum because their “everyday” experiences and ways of knowing, talking, and valuing are viewed as less “scientific” than ways of knowing, talking, and valuing demonstrated by White children. Deciding what counts as “scientific” is both informed and conditioned by teachers’ expectations regarding what is an acceptable response to questions in terms of what constitutes scientific reasoning. When teachers are not able to see strengths in the talk and reasoning of students such as Jerold, the opportunity to cultivate and situate the cultural and personal identities of Black boys as competent learners in STEM activities are missed. Moreover, when teachers fail to resign from dominant frames of reference when attempting to help gifted Black boys and those with high potential connect to STEM concepts based on their lived experiences, the sense-making resources that gifted Black boys bring to teaching, learning, and schooling are ignored, discounted, and trivialized (Wright et al., 2016).

When the material is not interesting or relevant to the lived experiences of Black boys, their cultural and personal identities are rendered invisible. If education is not relevant, it becomes meaningless. If there is a school–student mismatch, learning, achievement, and motivation are compromised. More specifically, if the curriculum does not engage Black boys, they may lose interest, begin to fail, and, in many cases, be removed from gifted education, or not be identified at all. To engage gifted Black boys in STEM teaching and learning that is culturally responsive and to maximize their opportunities to learn STEM concepts through literacy, we draw upon authentic multicultural children’s literature with a direct and intentional focus on cultivating and promoting STEM identities. In so doing, we use Ford’s Bloom-Banks Matrix.

Ford and Harris (1999) developed a twofold model called the Bloom-Banks Matrix to address the need to make learning rigorous and relevant for students. The Matrix, which combines or merges the best of critical thinking (Bloom, 1956) and multicultural curriculum (Banks, 2009), serves as a tool for teachers to use as they develop lessons that offer rigor with
substantive multicultural content for their students. Revised by Ford in 2011, and then by Trotman Scott who introduced a color code in 2014, the Matrix can be used to increase rigor and relevance in the classroom. In the sections that remain, we discuss how the color-coded Matrix can be used with the book How a Seed Grows written by Jordan (1992). While the book is about a Black girl the primary focus is on the content.

Culturally Respnsive STEM Literature to Engage Gifted Black Boys

Culture-purposed instruction must be implemented to ensure that students are not given a colorblind or culturally assaultive curriculum. Educators must ensure that culturally responsive practices, theories, and research are adopted in all classrooms and honors the kinds of talk and thinking that children use in their everyday lives. The Matrix is an innovative model that merges rigor and relevance—and when implemented with integrity, it can increase the interest and achievement of Black boys such as Jerold and create success for all students.

The Bloom-Banks Matrix: A Snapshot

As many educators are aware, Bloom's Taxonomy of Educational Objectives provides instructional rigor across six-level cognitive domains of critical thinking, creative thinking, and problem solving. When implemented with fidelity, teachers are able to determine the knowledge, ability, and skills of Black boys to know, understand, apply, analyze, evaluate, and create.

Rigor provides students with the opportunity to think and act accordingly, therefore, curriculum must allow students (in this case, Black boys) to see themselves positively reflected and affirmed in literature and curriculum. Banks's (2009) model of multicultural integration includes four levels (i.e., contributions, additive, transformation, and social action) that provide the multicultural rigor that is necessary in the classroom. Lessons at the contributions level focus on cultural artifacts and materials (e.g., food, games, celebrations, fashion, and folklore) in ways that are considered superficial. Lessons at the additive level focus on multicultural topics, ideas, and concepts in a safe way and during certain times (e.g., Black history month). Unlike the previous two levels, the transformation level promotes critical thinking by using multiple and alternative points of view beyond certain times in the school year. At this level, teachers infuse multicultural content in all subject areas, and topics, issues, and themes are deeper. Lessons on the social action level, which is the highest level on Banks’s multicultural integration level, has the primary objective of empowering students to be equity-minded change agents, social activists, service minded, and problem solvers. Students are taught and encouraged to make recommendations or act on their ideas, thus promoting voice and agency.

The Bloom-Banks Matrix (Ford, 2011; Ford & Harris, 1999) merges Bloom’s taxonomy (Bloom, 1956) and Banks’s (2009) model to create a model that epitomizes the goals, objectives, and perspectives of differentiation relative to rigor and relevance. The result is 24 cells that are placed into four quadrants. The lowest cell level is knowledge contributions and the highest and most rigorous cell is social action synthesis. As shown in Figure 1, Trotman Scott (2014) color coded the Matrix to conceptualize the differences and characteristics of each quadrant.

Quadrant 1 = red/stop

Lessons presented in this quadrant are low on both Bloom’s taxonomy but not Banks’s multicultural model. It is common practice for teachers to create lessons using the six cells in the red/stop quadrant. It must be noted that when lessons are low on Bloom’s taxonomy (knowledge, comprehension, and application) and low on Banks’s multicultural levels (contributions and additive), Black boys may not be challenged or interested in what is being taught and what they are assigned or required to read (Ford, 2011; Tatum, 2009; Trotman Scott, 2014).

Quadrant 2 = yellow/caution

High on Bloom’s taxonomy but low on Banks’s multicultural levels, lessons within this quadrant allow Black boys to use their critical thinking, creativity, and problem-solving skills. However, the multicultural content is superficial or presented in stereotypical ways. Gifted Black boys will be cognitively and culturally challenged, enlightened, and engaged by assignments developed using cells within this quadrant, but substantive multicultural content will be missing. Also, the yellow/caution quadrant is most commonly used when teachers are familiar with Bloom’s taxonomy but not Banks’s levels of multicultural integration (Ford, 2011; Trotman Scott, 2014).

Quadrant 3 = blue/guarded

Low on Bloom’s taxonomy but high on Banks’s multicultural levels, lesson plans developed using these six cells allow gifted Black boys to elaborate on events, facts, and characteristics of culturally different groups. This approach will help Black boys to become more aware and gain additional and meaningful knowledge about different groups, issues, concepts, and themes. Developing lessons using tools within this quadrant will provide Black boys with the opportunity to view cultural events, concepts, and themes through the lens and lives of others. But, although, this quadrant allows social action to take place, it is considered guarded because it does not require critical thinking and problem solving.

Quadrant 4 = green/go

High on Bloom’s taxonomy and Banks’s multicultural levels, lessons created within this quadrant provide Black boys with opportunities to think critically, solve problems, and review a multitude of multicultural topics, issues, and themes. It is also important to point out that Black boys are given the opportunity to suggest or make recommendations for social change on this level. Lessons in this quadrant are both rigorous and relevant. Moreover, gifted Black boys will be able to think and solve problems at the highest levels, while being exposed to content
### Quadrant 1

- **Knowledge/Knowing**
- **Comprehension/Understanding**

### Quadrant 2

- **Application/Applying**
- **Analysis/Analyzing**
- **Evaluation/Evaluating**
- **Synthesis/Creating**

#### Contributions

- **What kinds/types of seeds and plants are mentioned in the book?**
- **What is the definition of a seed? What is the definition of hair roots?**
- **Make a list of seeds that grow fast and those that don’t grow as fast.**
- **Why is it important to number the shells when you are conducting an experiment?**
- **Survey classmates about their favorite fruit or vegetable. Make a graph of the findings.**
- **Create another way to plant seeds instead of using pots and eggshells.**

#### Additive

- **What did you learn about an oak tree? What did you learn about a shoot?**
- **Explain why holes are needed in the bottom of cups and flower pots. What did you like and dislike about the book? What are the major takeaways you learned from this book?**
- **Using an eggshell, follow the instructions given and plant one or more seeds.**
- **What is more important for plant growth: water, sunshine, or soil? Is it possible to grow plants without sunshine and water? Explain.**
- **Conduct a study on two types of seeds. Predict which will grow faster and explain your prediction/hypothesis.**
- **Some fruits come from merging two seeds. They are called hybrids. One example is a nectarine (peach and plum). Create an idea for a new fruit or vegetable.**

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<thead>
<tr>
<th>Quadrant 3</th>
<th>Quadrant 4</th>
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<tr>
<td>Knowledge/Knowing</td>
<td>Comprehension/Understanding</td>
</tr>
<tr>
<td><strong>Transformation</strong></td>
<td>What does a seed need to grow? What are the major elements?</td>
</tr>
<tr>
<td><strong>Social Action</strong></td>
<td>Talk to a friend, classmate, or adult about the book. Talk about gardening and fresh, wholesome eating. Talk about gardening as a way to plant healthy fruits/vegetables and exercise.</td>
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Figure 1. Color-Coded Bloom-Banks Matrix applied to how a seed grows.  
Source: Adapted from Ford (2011) and Trotman Scott (2014).
that validates them as individuals (self-identity) and as members of a group. This is the ideal quadrant for all students (Ford, 2011; Trotman Scott, 2014).

Lessons developed using the Matrix will be useful in educational settings: gifted education, general education, twice exceptional, and special education classrooms. Teachers who adopt the Matrix can teach the same content on differing levels and allow all students, specifically gifted Black boys, to experience meaning and success on a level that meets their individual needs and interests, while affirming their self-identities and promoting agency. All students have the right to be educated using rigorous and relevant lessons, materials, and literature that situate their cultural and personal identities.

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**References**


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