



Teaching Culturally and Ethnically Diverse Learners in the Science Classroom

By Felicia Moore Mensah, Teachers College, Columbia University

Table of Contents

Cultural Foundations in the Classroom	2
Strategies for Science Teaching	3
Culturally Relevant Teaching Practices	4
Summary	5
Additional Resources	6
References	6

The Framework for K–12 Science Education¹ and the Next Generation Science Standards (NGSS)² posits a vision that promotes inclusion and equity, thereby presenting opportunities for effective learning experiences for culturally and ethnically diverse student populations. The Framework and NGSS present seven case studies in Appendix D “All Standards, All Students” to address learning opportunities and challenges for economically disadvantaged students, racial or ethnic minority students, students with disabilities, English language learners, girls, students in alternative education programs, and gifted and talented students.³ These seven cases offer ways of engaging students through culturally relevant teaching.⁴ However, many K–12 science teachers have not had teacher education or professional development experiences that focus on diversity and equity in science education or teaching approaches that center the experiences of students from culturally and ethnically diverse backgrounds.

In this paper, two common approaches in education are introduced. They are culturally relevant and culturally responsive pedagogy. These approaches have been used successfully with students from diverse cultural and ethnic backgrounds. In addition, the paper offers strategies for culturally relevant teaching practices in the science classroom.

Cultural Foundations in the Classroom

As teachers get to know their students and the assets and talents they bring to the science classroom, teachers can support students’ science content knowledge and engagement more purposefully with culture as a frame of reference. Culture as a broad term means the artifacts, beliefs, histories, knowledge, languages, symbols, and values that are part of any society, including our families. In education, an emphasis on culture through culturally relevant or culturally responsive teaching can be used in how we teach, what we teach, how we set up learning environments, and how we develop relationships with students in our classrooms.

Teaching culturally and ethnically diverse learners in the science classroom begins with the students. Students enter classrooms with an array of experiences that come from their personal and cultural backgrounds as well as from their interactions in the world. These experiences are seldom used in making connections with the science content taught in schools. As teachers learn more about students and their needs as learners, different pedagogical strategies are used that invite student participation and increase student engagement. Understanding and supporting culturally and ethnically diverse learners in the science classroom requires making classroom learning environments safe, engaging and, relevant.

Though there are similarities and differences between culturally relevant teaching and culturally responsive teaching, they are often used interchangeably by educators. Basically, these approaches differ in their orientation, yet they are similar in their focus on the academic success of students from diverse cultural and ethnic backgrounds. First, culturally relevant teaching originated from Gloria Ladson-Billings’ work to capture the pedagogical excellence of successful teachers of African-American students. By conducting ethnographic interviews and working with teachers, Ladson-Billings formulated notions of culturally relevant teaching or culturally relevant pedagogy. Ladson-Billings defines culturally relevant pedagogy as an approach to teaching that uses students’

cultural knowledge and backgrounds. She asserts that teaching should help students affirm their cultural identity while also assisting them in developing critical perspectives that challenge inequities in schools and other institutions. A teacher who enacts culturally relevant pedagogy teaches and believes that students can achieve academically; the teacher acknowledges that students have multiple ways to demonstrate cultural competence; and the teacher, as well as the student, understands and critiques inequities in school and in society.

In slight contrast, Geneva Gay offered a broader conception of her theory of culturally responsive teaching.⁵ In essence, Gay argues for a change in the pedagogy teachers use to improve the performance of underachieving students from various ethnic groups. Gay also explains that culturally responsive teaching is both routine and radical because the curriculum and content is taught through the cultural frames of reference of students from diverse ethnic and cultural backgrounds. Teaching is focused on the personal and cultural strengths, intellectual capabilities, and prior accomplishments of students. There is an explicit focus on the role of culture to improve learning outcomes.

Collectively, culturally relevant pedagogy from Ladson-Billings and culturally responsive teaching from Gay hold that curriculum, content, and teaching strategies for students of diverse cultural and ethnic backgrounds offer students opportunity and access to gain significant knowledge and skills in the classroom, while upholding the unique ways that students learn, communicate, and interact. For example, culturally relevant education approaches have been used broadly in education, including mathematics education, English education, social studies education⁶, and science education.⁷ Students' encounters with education are more relevant and responsive to their particular needs as learners.

Strategies for Science Teaching

Both culturally relevant and culturally responsive approaches can be applied in the science classroom. However, a first approach to incorporate culturally relevant teaching approaches in K–12 science classrooms is to think about who the students are and what assets and talents they bring to the classroom setting. By inviting students' backgrounds and experiences into the classroom, teachers can support their science content knowledge, skill development, and engagement in the classroom. A second approach is to consider the pedagogical supports that students desire and those that will aid their learning of science. Below are some strategies and examples for culturally relevant teaching in the science classroom. Many of these examples may be shared across K–12 classrooms

Culturally relevant teaching can transform the ways that teachers think about learners, the content, and the learning environment to capitalize on the learning style of students from diverse cultural and ethnic backgrounds. In particular, teachers have to understand and appreciate the cultural experiences of students, including learning styles and language, and relate these to the science content being taught in school.⁸

Teachers in K–5 classrooms can collect information about their students’ experiences in science outside of school through short intake forms, questionnaires, surveys, and short interviews. If teachers collect this information early in the school year, as a means of getting to know students, where information gathered can be used for lesson planning and instruction, such as incorporating students’ interests outside of school into science units and including topics of interest into lesson plans. Extending these ideas, elementary learners can complete an oral history project where they interview family members, community members, or elders and connect community-based science knowledge to ideas they learn in school science (i.e., studying home remedies for sicknesses). Storytelling through oral and written presentations is one way to highlight and develop communication skills, writing, and sharing of community-based, cultural knowledge.

Teachers in 6–8 classrooms can allow middle school students to collect data on issues that are important to them and their communities. From their data, they can analyze it from different perspectives and suggest how science can be used to solve problems. Teachers can allow students to propose what they would like to do for classroom projects based upon what they are learning in the science classroom. For example, from studying environmental issues and sustainability concepts in the science classroom, students may propose a clean-up day in their neighborhood or local park or donate time at a community garden. Understanding the local context to improve conditions within their community is a relevant place based project to motivate interest in applying the science learned in the school.

Teachers in 9–12 classrooms can promote more collaborative learning and teaching in high school classrooms. Students can work together in teams and assist in teaching science concepts and content to their classmates. In the process, students focus on developing scientific language as they explain concepts in science that also connect to them in personal ways. Using multi-media and other digital tools and apps can support creativity in sharing information and learning science content. Students may plan community science fairs to share what they have taught and learned to the school and larger community.

Culturally Relevant Teaching Practices

In addition to the examples above, there are a host of pedagogical and assessment strategies to support culturally and ethnically diverse learners in the science classroom. For example, teachers can use whiteboards for student responses, either individually, in small groups, or for whole-class learning. They can also use butcher paper and bulletin boards in the classroom to respond to questions, to post questions, to draw, or to create graphic organizers. Because technology is a critical component in society, teachers should encourage the use of educational games that correspond to skill and content development in science. For classroom learning, teachers should provide ample opportunities for students to share their thinking and encourage students to respond to each other’s comments and questions. By using flexible groupings, science teachers can help students work with different peers on assignments, thus increasing the opportunity for students to learn from each other, to get to know each other more, and to build classroom community.

Though not an exhaustive list, additional strategies are in the table below. However, before engaging in any of the strategies suggested in the paper, teachers must be reflective of their practice and begin to center their teaching on the needs of all students. Incorporating these strategies with purpose and intention to promote academic success and learning for culturally and ethnically diverse students requires time, effort, and support.

Table 1. Culturally relevant teaching practices

Honor and respect the children’s home culture.	Encourage students to learn from each other.	Use familiar analogies and metaphors to teach content.
Scaffold or build bridges to facilitate learning.	Establish trusting relationships with students.	Demand critical thinking and reflection from students.
Ask students’ feedback on lessons and effectiveness of instruction.	Ask higher order questions equitably to all students in the classroom.	Engage students in solving meaningful, real-world problems and apply content understanding.
Provide multiple forms of assessment.	Believe that students are capable of academic success.	Use visuals representative of diverse cultural groups.
Foster a sense of community in the classroom.	Motivate students to become active learners.	Legitimize students’ real-life experiences.
Present content in multiple forms (i.e., video, manipulatives, print, etc.).	Communicate and work with parents/guardians on regular basis.	Invite community members into the classroom to teach and participate.
Develop a student-friendly learning environment.	Build on what students know and what interests them.	Use diverse resources in planning lessons.
Plan lessons that teach students about their cultural background.	Arrange the classroom to support discussion and small group learning.	Acknowledge all students’ comments, contributions, and questions.

Summary

Teaching culturally and ethnically diverse students in the science classroom requires that teachers not only acknowledge but also utilize the cultural capital that students bring to the classroom. Their cultural knowledge, frames of reference, linguistic styles, interests, performance styles, and prior knowledge are assets that make science learning more effective and relevant for them. As a starting point, teachers need to get to know their students more deeply. They can adjust their approaches to teaching by making classroom learning environments more collaborative, offering student choices, and inviting different ways of communicating, sharing, and listening into their science classrooms.

Cultural approaches to science teaching do not negate the importance of the content; rather, culture broadens the accessibility of content for the student. Teachers and curriculum developers should include opportunities for students in K–12 science classrooms to become connected to learning science through their cultural and ethnic backgrounds. Cultural and ethnic diversity are assets in the development of science-curriculum materials and approaches to science education.

Additional Resources

There are many online resources to support teachers and curriculum developers for culturally relevant and culturally responsive teaching. Not all the websites are specifically science-related, but they offer very useful approaches to expand curriculum development, lesson-planning ideas, and strategies that focus on student learning, diversity, and equity in education.

EdChange	http://www.edchange.org/
Edutopia	https://www.edutopia.org/
Shelburne Farms	https://shelburnefarms.org/
Teaching Tolerance	https://www.tolerance.org/

References

- ¹ National Research Council (NRC). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press, 2012.
- ² NGSS Lead States. *Next generation science standards: For states by states*. Washington, DC: The National Academies Press, 2013.
- ³ NGSS Appendix D. <https://www.nextgenscience.org/sites/default/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf>
- ⁴ Ladson-Billings, Gloria. “But that’s just good teaching! The case for culturally relevant pedagogy.” *Theory into practice* 34, no. 3 (1995): 159-165.
- ⁵ Gay, Geneva. *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press, 2010.
- ⁶ Aronson, Brittany, and Judson Laughter. “The theory and practice of culturally relevant education: A synthesis of research across content areas.” *Review of Educational Research* 86, no. 1 (2016): 163-206.
- ⁷ Ladson–Billings, Gloria. “But that’s just good teaching! The case for culturally relevant pedagogy.” *Theory into practice* 34, no. 3 (1995): 159-165.
- ⁸ Lee, Okhee, and Sandra H. Fradd. “Science for all, including students from non-English-language backgrounds.” *Educational researcher* 27, no. 4 (1998): 12-21.