

Cultural Relevant Literacy to Support Academic Achievement in STEM

Introduction

The word “culture” is derived from a French term, which has originated from the Latin word “colere”, meaning to tend to the earth and grow, or cultivate and nurture. The figurative sense is “cultivation through education, systematic improvement and refinement of the mind” (1500 Century Dictionary), learning and the intellectual side of civilization referring to collective customs and achievements of people, referring to a particular form of collective intellectual development. *Culture* is shared by a group of people who believe in common values (Malloy and Malloy, 1998). *Culture* is social behavior and norms that a specific group practice.

Cultural Relevant Literacy

A cultural relevant literacy program will use diversity in the student body to help students and support the unique need of the students. Culturally relevant teaching in Leonard & Guha (2002) is described as “a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes” (Ladson-Billings 1994, pp. 17-18). A culturally responsive teaching is to create a curriculum relevant to the linguistically, ethnically, and socioeconomically diverse students so that the students feel a strong connection to the school and feel valued as individuals within the school community. It is to create a stronger culture in the school and make students feel safe, supported, and valued. The goal for the faculty is to build the culture in the school, build relationships between students and teachers, and allow for opportunities for students to learn about things that are relevant to

them. The outcome of cultural relevant literacy is to create a positive relationship between teachers and students and as a result students enjoy learning and earn better grades in academia.

Traditional Teaching Methods vs. Culturally Responsive Teaching

In traditional teaching method, teachers teach in a way that they were taught. Teachers use literature from classic authors, and present interpretations of the text that is widely accepted. Culturally responsive teaching, not only acknowledge traditional texts, but also includes texts from other cultures, from different parts of the world, and also from by diverse authors. Learning then becomes more meaningful and real life.

Why is Culturally Responsive Teaching important?

Today teachers have more diverse classrooms. The students come from different backgrounds and experiences, therefore, instruction has to be adapted. Teachers need to build on individual and cultural backgrounds and experiences, and also scaffold on prior knowledge of the students. Culturally responsive teaching is not just continuing typical, mainstream education but focus on the realities of today's students and reflect differences. Culturally responsive teaching is an important teaching outlook for everyone. If culturally responsive strategies are integrated into classroom instruction, it can have important benefits, such as:

- promote inclusivity and equity in the classroom
- strengthen students' sense of identity
- engage students in the course
- support critical thinking and problem solving

If culturally responsive strategies are integrated properly, it can be transformative for the students. Students can relate to their background and engage in further learning.

Culturally Responsive Teaching Strategies for Educators

To integrate culturally responsive teaching, educators need to build on students' prior knowledge. Students with different background bring diverse experiences. Teachers could encourage students to draw on their prior knowledge to contribute to group discussions in class, that provides enriched learning for everyone. Learning then becomes more contextual and meaningful. Further, to make it more relevant to the students' social communities, teachers could integrate lessons from different cultures. In addition, teachers could emphasize why something of past matters today. Teachers can take the concept that students are learning and create a project that enables students to draw parallels. Also encourage each student to share their culture so that the students could contribute and be valued in the class. Teachers need to relate to each student's culture so that no one feels left out. In a mixed classroom, it is important to empower the minority students to make them feel important. Moreover, it could be a good idea for the teachers to take initiative to learn about the culture of the students. If teachers need to learn about different cultures, there are abundance of information on the internet but teachers should consult with the parents as parents are a resource.

Teachers need to reflect and reconsider the classroom environment. There are small changes the teachers can make to the classroom to be more culturally responsive.

Teachers can take inventory of the books in the classroom library: Following questions could guide the teachers to examine the classroom library:

1. Does the library include authors of diverse cultures?

2. Does the library include different gender? Is LGBTQ community represented?
3. Does the library represent both urban and suburban families?

Further consider the posters displayed on the walls and the bulletin board. It is important to build relationships with the students. Building relationship is to talk to the students, work with the students to ensure that the students feel respected, valued, and seen for who they are. Building those relationships helps students build community within the classroom and with each other.

If students in a classroom are all ethnically similar, often teachers struggle how culturally responsive teaching strategies apply to them. It is even more important to teach students about diversity to ethnically similar group as it benefits everyone. Teachers are educating the global citizens for the future . Teachers are the role models and have the power to impact the lives of their students. Therefore, thoughtful inclusive instruction from the teachers can have positive effects on the students that could last far beyond their time in the classroom. Having culturally responsive teaching strategies is only a small step toward making meaningful change in education.

Culturally Responsive STEM Education

The student population in the U.S. is becoming more ethnically diverse. Providing quality, equitable STEM education for PreK-12 students, require teachers to rethink and restructure the curriculum, instruction, and assessment so that students' cultural practices are valued. This is more important, particularly students who have been historically underrepresented in STEM fields.

To generate interest among students in STEM related field, as Schwartzbach-Kang (2019) points out teachers can help students think creatively outside the box while making connections in STEM and pop culture. It relates to something the students enjoy and is a part of their culture outside school. Guha (2021) mentioned teachers can integrate music in teaching mathematics to children. This helps connect students' social and emotional needs. Music captures interests of the students and they enjoy learning mathematics and science. Similarly, in another study, students were asked to make musical projects and productions where the participants were tasked with research, collaborative discussion, and creation of a music program. Through multiple iterations, the girls listened to the sound and then edited the sound accordingly so that it fits with rap vocals (Champion, et al., 2020). This exploration and design process connects to the students growing computer literacy in addition to their ability to listen to sound and manipulate it to fit in their design and intended project. Moreover, in order to make teaching more inclusive and culturally responsive, teachers were offered workshop and training. They changed their approach to teaching and became aware of the barriers or any other types of factors that might create a fixed mindset (O'Leary et al. 2020).

School, Home and Community involvement with STEM focus

Following are few strategies how teachers would focus on STEM. An elementary grade public school teacher stated that her second grade students would definitely benefit from a STEM project in class. She said that she would create a STEM project with investigations to study topics based on students' interests (such as different animals,

plants, nature...) The students would begin with investigating STEM tools to introduce them to the scientific method. She said that she would create a lesson that encourages the students to explore how to use tools to test their predictions. For example, the students could use microscopes, magnifying glasses, binoculars, tongs, eye droppers, scissors to investigate a sample that they have a question about. For example, what kind of plant does this leaf come from? The teacher would guide the students to use these tools. The main objective is to develop the inquiry skills so that the students would learn to ask questions to investigate their objects. The students learn to organize their ideas, develop and test hypotheses, and then build upon their knowledge by using the scientific method. Then the teacher would ask the students to complete a lab report. The lab report is required to describe the experiments and state the hypotheses, experiments, and results. The lesson could contain a prompt, that is designed to get the students to ask questions about STEM concepts related to a topic they are interested in. It is a guide for the students to develop inquiry about a topic by using the tools in a scientific method.

On the very first day of school, an elementary grade teacher asked her 4th graders what their favorite subject was and many of them said "Math was their favorite subject". The teacher said that she was pleasantly surprised because she didn't like math when she was young, however, she grew an interest in teaching mathematics. Then she stated that the first step she would take in creating her lesson is to make it appealing to the young ones. She makes her lesson engaging, hands-on and also connects to the real world. She creates her lesson in such a way so that they could continue learning even outside of school. For example, the school had an indoor garden and a hydroponic system. The teacher said that she will have the students do an

experiment to regrow food in water as many may not have access to be able to garden outdoors. The science skills come from growing organic food and since water is readily available, it would be more convenient way to help in their learning process. The engineering skills would be applicable to what else would be needed such as the scrap rib of a celery or the scrap shoot of a lettuce/ green onion. The students would have to engineer what is required to make the plant grow; sunlight and the quantity of water and then research on the type of water efficient container. The teacher planned to have the students measure the plant growth using a ruler and document each measurement on an excel sheet for data. Students could also record volume of water needed for plants to grow. Photos of each plant's progress can be added for record keeping. The students were learning STEM by growing food. With this project, they were combining math, science, and technology to grow their produce. The students were put into groups or teams to work together. Instead of doing the regular worksheets about hypothesis and control variables, they were learning about hypothesis and control variables by their actual project and hands-on growing.

Teacher's goal is to make STEM lessons as inclusive and culturally relevant as possible

The authors O'Brien & Keister (2008) in their article stated about the importance of Social and Emotional Learning (SEL) and further mentioned that SEL is most effective when it is part of a schoolwide initiative that establishes norms for appropriate positive behaviors among students, promotes well-managed, safe, caring, cooperative, and participatory learning environments, implements evidence-based, sequential, and ongoing skills instruction for all students and integrates those concepts and skills into every subject and aspect of school life. Moreover, the authors mentioned that although there are racial and gender disparities in

STEM yet in school, teachers can teach students about STEM achievements by people of color. It is important to teach students about current events relating to different minority groups and help students understand interdisciplinary texts, diverse forms of texts by diverse authors. For example, to understand environmental inequity, teachers can focus on the resources people have in places affected by droughts to explain how socioeconomic status impacts resources that groups have for protecting themselves against climate change.

It is important for schools to select culturally relevant texts, authors, and perspectives for students to consider across disciplines, especially in STEM subjects. It motivates students when they see themselves and see their interests reflected in text and literacies through pop culture, current events, personal experience, and diverse cultures. Culturally relevant literacy promotes higher interest in STEM fields if students are able to engage themselves in ways that are meaningful to them. It increases motivation and work ethic among students to engage in STEM fields.

Involving home and community is important because these are the immediate environments of the students. To promote home and community involvement, teachers could ask the students to share their interests, family life, cultures, and activities they usually participate in. Teachers could include mathematics word problems that are inspired by students' stories and include the students' names in the lessons. Further, students also may share their family members' jobs. For example, if someone's sibling is a pizza delivery person or if someone's parent works at a hair salon, the teacher could make a math word problem about how many pizzas are sold in an hour, or how much money the store should charge for a pizza pie or for a haircut. In that way, the students would not only feel welcomed and included in the lesson, but they will also be more engaged in the lesson.

Teachers could assign students a partner project. With a partner, students would select a location and research it. They would learn about the attractions, history, and events happening in that location. Students could be asked to post at least one paragraph on the researched place on-line and they would be able to read each other's writings. This builds a sense of community feeling and focuses on writing with integration of technology. For math connection, students must find and include in their paragraph at least one math fact about the place. For extra credit, students could go to these places in the city in groups or individually.

Teachers could involve the students in the community around them by making the community the classroom. Students are able to learn from their community about the buildings and street planning they observe and apply it to their own town. Teachers could ask the students to view the streets and buildings to make connections to perpendicular and parallel lines, prisms, and pyramids.

In addition, the students could write letters to the community members and get involved on a social cause that is important to them. Students make use of the community to learn from the resources and people around them and that influence their lives inside and outside of the classroom. For example, students in a group could write a letter to a city's representative to narrate how a building is affecting the ecosystem and offer solutions to solve the problem.

Further, a teacher could direct the students to look for information from a website to find out which animals in a certain place are endangered. Students could select one animal they want to focus on and complete a short writing assignment. They will research what is causing the animal to be on the endangered species list and then state some ways that they might be able to save the animal. Similarly, in another project, students could select an animal and find out about the habitat, food habits, diet, and how climate change affect the population growth. For a community

application, the students can observe what species of animals are in their home environment and what they can infer about climate change would do to the population statistics. They could examine the animal's diet and where they can find such diet. They can predict if the animal faces a natural population or decline over time.

To continue a project from school to home, the teacher can ask students to create a nature journal to record the growth of a specific plant throughout the year. This helps the students learn about how a plant responds to different temperatures through different seasons. For example, during fall to winter, the plants will have no more trees but during spring the plant will start sprouting leaves and flowers. Additionally, to involve the community, teachers can ask the students to reflect on the various weather changes in the surrounding environment. Also report what possible effects climate change may have on the community. For example, if the temperature raises by 2 degrees, certain areas may start flooding because of coastal flooding and glaciers melting. Thus, students need to research and reflect on how this would impact local area they live in. Students can focus on a problem and also brainstorm ideas to solve the problem.

Apart from what schools could offer, outside of school, students could be part of a summer program or after school program that would nurture students' interest in STEM subjects. Following is an example of a community program to get students interested in STEM.

The Intrepid Museum's GOALS (Greater Opportunities Advancing Leadership and Science) for Girls' program is an example of a STEM that focuses on youth development program. Engrained in the mission and vision, GOALS continues to develop deeper understanding of an execution of culturally responsive teaching and practices. The diversity of New York City allows GOALS to interrogate, listen and respond to youth voice through active program assessment and student reflection. Through funding and thoughtful partnerships with

leading organizations and professionals, the GOALS program utilizes a multi-tiered approach to provide under-served communities and most excluded youth with STEM learning and youth development opportunities in New York City. Starting with the GOALS for Girls Summer Intensive, as free 6-week, application based, STEM and humanities focused program that provided 50 rising 9th and 10th grade female students of New York City with hands-on, inquiry-based and real-world application of science, technology, engineering, art and math. Complete with engaging workshops, fieldtrips and mentorship with influential women in STEM, GOALS students re-discover and expand their awareness of their STEM curiosity and career goals. The GOALS for Girls program understand the importance of continued development and engagement with program alumni and women in STEM. Through the paid internship-mentorship program, an application-based school year long opportunity, GOALS alum and mentors participate in student-led projects, mentorship development and workforce skills. Lastly, GOALS recognizes the need to reach more teens, youth and communities and therefore, offers 5-6 free teens events and programs throughout the school year. With two events focusing on STEM careers and developments, two on youth development in the form of Mentorship and College Fair and the last two as larger celebrations and summits, Girls in Science and Engineering Day and Virtual Youth Summit, respectively. Such events broaden the scope of GOALS and offers opportunities for diverse teens, families and communities to participate and expand their STEM, mentorship and college-career readiness toolkits towards their personal and professional success. In all three tiers of the GOALS program, CRT is integrated in the curriculum, planning and engagement with students and communities. Such strategies and best practices include virtual GOALS Informational offered as open and "private" presentations and workshops to targeted low-income and underserved communities in New York City. During the

Summer program, GOALS staff utilize student-centered language and support open forums of culture-sharing and celebrations. Within the internship-mentorship program, mentor trainings are inclusive of supporting safer-braver spaces and incorporating personal storytelling to build and establish trust among mentors and GOALS interns. The GOALS teen events, continually highlight, celebrate and feature people and organizations with people of color in STEM fields.

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Conclusion

Culturally relevant teaching should empower students intellectually, socially, and emotionally. Bringing diverse culture in the curriculum enriches the curriculum and benefits all students. Building a positive relationship with teachers and students is important for students' development. School, home and community involvement is important for students to continue learning. There is a need of exposure to STEM subjects early on in education.

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