

The New York City Classroom - An increasingly diverse population

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Culturally Responsive Science and the Billion Oyster Project

It is important for teachers to realize that their classrooms are becoming increasingly diverse. Nowhere is this more evident than in the schools of New York City. Many of the students come from a plethora of backgrounds and in fact, there are as many as 800 languages spoken in New York City, making it the most linguistically diverse city in the world. Approximately 36% of the city's population is foreign-born, substantiating the fact that the students in NYC classrooms will not have had the same cultural experiences as their teacher (Hernandez et al, 2013). In order to be successful in this setting, a teacher must create a positive, welcoming, and engaging environment. To do so, one may employ what is referred to as a culturally responsive education. Culturally responsive education emphasizes the link between culture and classroom instruction (The Knowledge Alliance: Brown University, 2008). It recognizes and respects students of varying backgrounds by acknowledging their differences in language, culture, life experiences, and values. In order to achieve this, teachers must implement the following strategies: communicate high expectations, use active teaching methods, act as a facilitator, create positive ties with community members, possess cultural sensitivity and reshape curriculum to address students' backgrounds. In addition, situated learning or learning in an authentic context that focuses on problem-solving skills, is vital for the acquisition of content knowledge (Altomonte, et al, 2016). Each component is pivotal to creating an atmosphere where students are willing to learn and are engaged in the learning process.

In a classroom where traditional western teaching strategies are emphasized, teacher-centered instruction is used in the majority of learning experiences in the United States. The teacher is viewed as the giver of knowledge, and students are often passive during the lesson, receiving rather than exchanging ideas. There are few opportunities for discussions led by students. Thus, an increasing distance between teacher and student is established (Sohn, 2016). This method is linked to lower achievement in diverse schools where teacher-centered instruction leads to decreased achievement in minority students (Cylan & Akerson, 2013).

In addition to students being unable to relate to content because of the way it is delivered, there is further disconnect between students and the curriculum itself. This discrepancy between students' interests in science and materials used to learn science can be observed as early as middle school and continues in science classes at the high school level and beyond (Hagay & Baram-Tsabari, 2015).

Culturally responsive education has been noted for helping students of diverse backgrounds especially when their ethnicity is in the minority (Hernandez et al, 2013). Prior to preparing lessons or a curriculum, teachers and the school must engage in building connections with diverse communities and communicate with students of diverse backgrounds (Gay, 2002).

Students in New York City are educated in a singularly unique setting both geographically and culturally. New York City is comprised of five boroughs that occupy 305 square miles. It is the most populous city in the United States and home to 8.5 million people or approximately 28,000 people per square mile. In addition to its land mass, New York City's harbor is one of the world's largest natural harbors, comprised of both an inner and outer harbor. It is located at the mouth of the Hudson and East Rivers and forms an estuary which was once teeming with wildlife.

There is a misconception that a culturally responsive education solely focuses on culture acknowledgement in the classroom. As with all learning experiences, the goal of a culturally responsive education is academic achievement. Through culturally responsive education, learning is placed into culturally relevant context, thus eliminating the cultural disconnect between students and their teachers (Bouette, Kelly-Jackson, & Johnson, 2010). All students benefit from culturally responsive teaching because skill acquisition is situated in life experiences and provide students with a framework for learning where content development is both meaningful and enriching.

Research shows that marginalized students excel in courses where they are actively part of curriculum construction. Improving student engagement increases knowledge acquisition.

Currently, students in New York City public schools are experiencing severe academic segregation especially in the areas of mathematics and science. The education that precedes high school will determine not only the high school that students in New York City will attend but also the course of study that they will pursue. This, in turn, will determine if they go to college and the major they will select. The repercussions are long term and socioeconomically decisive. So it is at the middle school level, where children are capable of making informed decisions, that students should be allowed to explore educational options that are relevant to them and their community.

The Billion Oyster Project as Culturally Responsive Education

In a study administered to elementary African-American students, interviews were conducted to determine their perceptions of culturally responsive education (Howard, 2011). The data uncovered three major preferences of the children interviewed: (1) caring teachers, (2) teachers who established classroom environments that mirrored the community and (3) teachers who made the learning experience interactive and engaging. By its very nature, the Billion Oyster Program is culturally responsive in a number of ways. The focus of the program is based in S.T.E.M. (Science, Technology, Engineering and Mathematics) education. STEM as channeled through the Billion Oyster Program, affords students the opportunity to perceive the world through pro-active experiences in the community in which they live. The BOP (Billion Oyster Project) is unique in that it enables the students to combine the classroom experience with the fieldwork necessary to restore a vital piece of their community – New York Harbor and its estuaries. Borrowing from the constructivist theorists such as Dewey, Piaget and Bruner, cognitive development is dependent on experiential learning by providing activities that engage the learner. The BOP initiative allows students to be engaged in raising oyster larvae, building and operating oyster nurseries called “restoration stations” and conducting long-term research projects focused in their schools and communities. In addition, the students are exposed to the complexities of the business world and its connection to the harbor through the shell collection segment of the project. In all, there are fifty-three restaurants locate in the five boroughs of New York City that take part in the shell collection effort. Finally, the students also see the connection to the health and well-being of not only the aquatic aspect of the harbor but also the well-being of its citizens. Through the public outreach by the New York Harbor Foundation, awareness and involvement of community members continues to be fostered and grown.

The Billion Oyster Project Fieldwork benefits to the culturally diverse

A 2009 study conducted by researchers at Purdue University (Riskowski, Todd, Wee, Dark & Harbor, 2009) discovered that middle school students who were educated through a hands-on learning method about the effect of human impact on the quality of water, showed higher comprehension of the concepts, particularly among those students where English was not their first language. This was compared to the traditional method of textbook learning on the same content. It was found that experimenting increases a student’s admiration and comprehension of science and its role in society. Further, having students participate in science fairs and expos to present their findings, helps develop not only their mathematics and science content but also their communication skills and “emotional intelligence” that can endure throughout their academic experiences. The Billion Oyster Project Symposium is held each June to allow the students to showcase the work they have done and explain their findings.

The Billion Oyster Project is concentrated in fifty-four New York City public middle and high schools throughout the five boroughs. Because the boroughs are located on three major islands in the harbor (Manhattan Island for Manhattan and the Bronx, Long Island for Brooklyn and Queens and Staten Island) direct access to the water by any of the schools is possible. Students begin their experience with BOP through a basic historical, biological and economic initiation to the harbor. Next, the protocol on the Oyster Restoration Stations is presented and the students begin their journey both in the classroom and in the field. Observing and recording site conditions, assembling and installing the mobile trap at the oyster restoration site, and monitoring oyster growth and water quality enable the students to experience the real-world component and citizen science aspect of the project. Back in the classroom, these same students now study the mathematical, earth science, biological science, chemistry and physics all tied to the hands-on work. This synergetic pairing creates a synergetic learning situation that enhances engagement and content knowledge due to its relevance to the students and the community.

As can be surmised, this process does not happen without thoughtful planning and a great deal of effort by the New York City teachers, the New York Harbor Foundation Staff and members of the Pace University Science Education faculty who have committed themselves to this effort.

New York City public school teachers become aware of the Billion Oyster Program through a variety of outreach efforts directed by the New York Harbor Foundation and Pace University School of Education and several of their partner organizations¹. This effort is funded by a 5-year National Science Foundation grant (#1440869) entitled "Curriculum and Community Enterprise for New York Harbor Restoration in New York City Public Schools".

An application process for New York City middle school teachers (Grades 6-8) working in Title I designated public schools is conducted each spring and principals of the schools are encouraged to participate in the program. In return, the grant provides a professional development program which includes a stipend, technical training, field site for the restoration stations, classroom curriculum, scientific equipment and supporting resources. The professional development training for classroom and after-school teachers, entitled BOP Fellowship at Pace University includes workshops conducted by scientists, field training days, Oyster Restoration Station Monitoring trips, Aquarium and Reef Exhibit field trips and the annual BOP symposium for teachers and their students. A Pace STEM Collaborative showcase and a video of the teachers' personal reflections are also activities that are encouraged. The students are able to reap the benefits of all of this training and advanced preparation in a number of ways. The small learning communities have been key to the increase in student achievement through enhanced instruction and curricular development by the team (Schmoker, 2006). By creating this community of like-minded teachers, environmental scientists, and marine related professionals, a rich and rigorous course of study has been developed that includes real-world applications and hands-on experiences in the harbor.

To add to this sense of community and sharing, the Oyster Restoration Station data is uploaded to a platform to compare with other students from other schools across the city.

As stated by Linda Darling-Hammond, "A substantial body of research over the last 40 years has found that the combination of teacher quality and curriculum quality explains most of a school's contribution to achievement, and that access to curriculum opportunities is a more powerful determinant of achievement than initial achievement level". In other words, when students with similar backgrounds are placed with high quality teachers and who are armed with rigorous curricula, there is a notable and positive difference in his/her academic achievement level.

Preparing the cohorts of dedicated educators in the Billion Oyster Curriculum, linking the classroom-fieldwork experience for the students, involving numerous partner organizations that contribute to field trips, after-school programs and experiential learning experiences, works to lessen the achievement gap that persists with culturally diverse learners.

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¹ Partners in the BOP Project include : Pace University School of Education (lead), New York Harbor Foundation, New York City Department of Education, Lamont-Doherty Earth Observatory, New York Academy of Science, Good Shepherd, New York Aquarium

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