

Diversity and Inclusion in the STEM Classroom

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What is Diversity and Inclusion?

The Oxford Dictionary defines **Diversity** as

the state of being diverse; variety

the practice or quality of including or involving people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc.

The Oxford Dictionary defines **Inclusion** as

the fact of including someone or something; the fact of being included

Source: Oxford English Dictionary, 2nd ed. (Oxford: Oxford University Press, 2004)

What does Diversity mean to me?

Diversity means many different things to me as an educator.

Diversity means recognizing that each individual is unique, and recognizing our individual differences.

Diversity in education means providing many diverse learning materials to encourage students with different perspectives to successfully demonstrate their understanding.

Diversity means building a culturally responsive classroom.

Diversity means advocating for racial diversity in Science and building safety guidelines to accommodate students with differences in race, gender, socio-economic status, ethnicity, sexual orientation, etc.

What does Inclusion mean to me?

Inclusion means including every student in class

Inclusion means providing equal access to all students

Inclusion helps students feel valued and all students have equal access to learning opportunities

Inclusion goes hand-in-hand with diversity education, in my opinion, it is virtually impossible to separate one from the other

Inclusion helps students encourage each other and promotes a safe learning environment

Two ways I incorporated Diversity and Inclusion

- Introducing innovative hands-on assessments to replace some written assessments
- Providing diversity education to my students

Diversity in Assessments

Innovative Projects

- Heart Model Project
- Graphic Novels Project

Heart Model Project



Figure 1: Student heart models from Physiology and Disease class Fall 2013

Graphic Novels Project

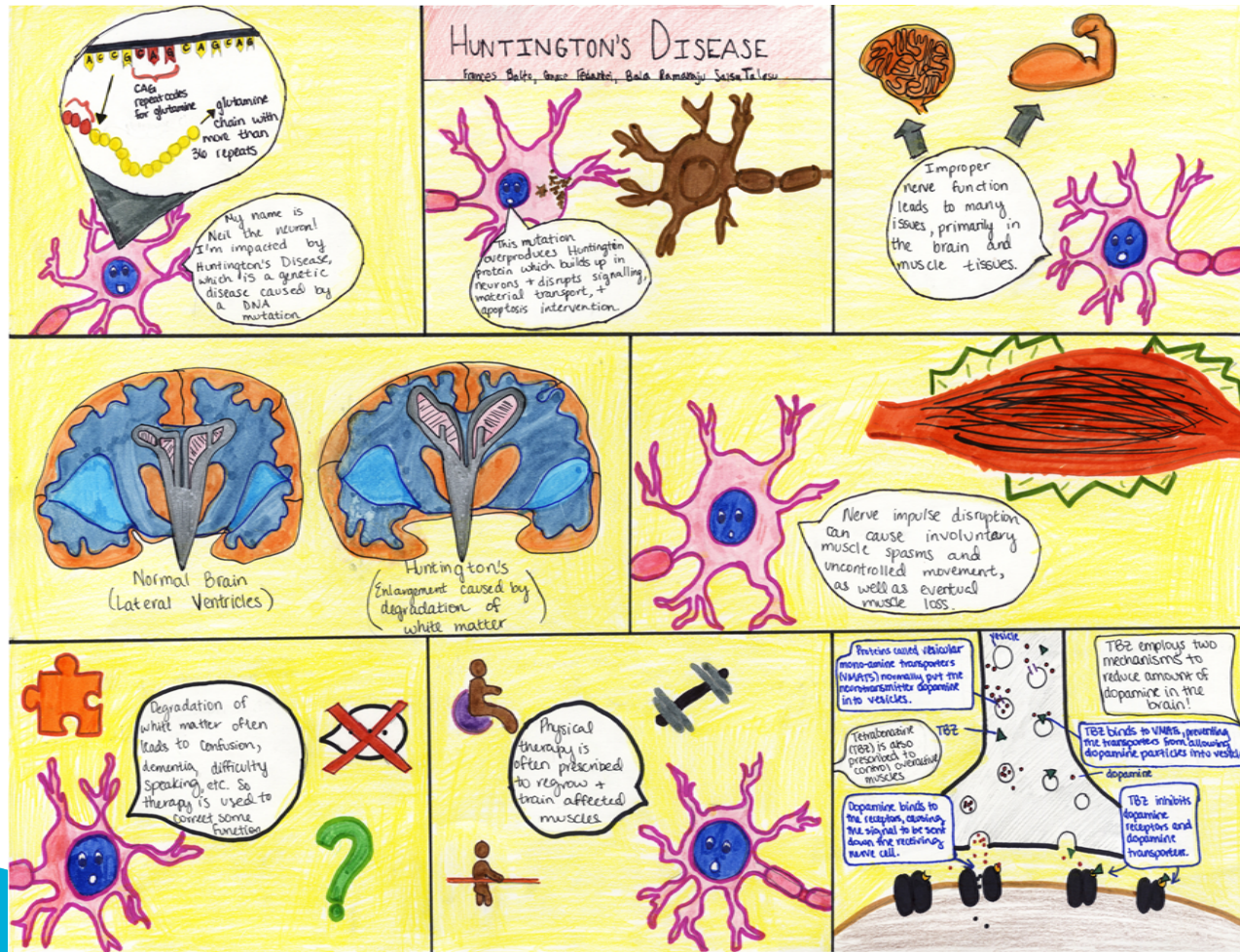


Figure 2: Student graphic novel depicting the pathophysiology of Huntington's Disease
Balto, F.; Federici, G.; Ramaraju, B.; and Talasu, S. (2019). "Huntington's disease". Human Diseases Graphic Novels. 28.
https://digitalcommons.imsa.edu/hd_graphic_novels/28

Student Feedback

- “This is a cool way to understand Physiology.”
- “I loved making the heart, it taught me so much. I learned that it is okay to fail many times before I succeed!”
- The graphic novels are so awesome, I have never done anything like this before. I learned so much more than just giving a presentation and it was fun too.”
- “I did better on the quizzes because I understood the material better by doing these projects.”
- “I could use my artistic skills to do these projects.”
- “I finally found a class where I could learn material in a different way.”

You can do it too!

- Anjur, S. 2011. Improving Student Performance in Inquiry-Based Science Courses. Spectrum(the Illinois Science Teachers Association Journal (Winter 2011 issue), 36(3):23-25.
https://ilscience.org/resources/Documents/SPECTRUM/Spectrum-V36N3_2011-Winter.pdf
- Anjur, S. 2015. Using Heart Models for Physiology Teaching and Learning. Spectrum (the Illinois Science Teachers Association Journal (Winter 2015issue),40(3):33-37.
https://ilscience.org/resources/Documents/SPECTRUM/Spectrum-V40N2_2015-Winter.pdf
- Anjur, S. (2020). Graphic Novels in Biology – A Novel Assessment Idea. The Journal of the Illinois Science Teachers Association, Spectrum, Winter 2020, 42(1): 28-37. <https://online.fliphtml5.com/wfyac/iyks/#p=29>

Diversity Education

Rationale for Diversity Unit in Science Classroom

Humans are by nature egocentric and socio centric as well. We believe that the groups we belong to are right, privileged, special. We systematically deceive ourselves into thinking that we are right, we avoid recognizing our biases and treat people and groups without due consideration and respect, even when there is clear evidence to refute our point of view. (Elder, 2004).

Elder, L. (2004). Diversity: Making sense of it through Critical Thinking. The Critical Thinking Community.

Rationale (continued)

Through this unit, I hope to teach students to be aware of, and to guard against, their native egocentric and socio centric tendencies. Otherwise these tendencies will keep them from reasoning well through diversity issues.

General classroom dynamics

- Students at the Illinois Mathematics and Science Academy are selected for their aptitude in Math and Science
- Perception of inequality and exclusion among gifted population
- Promote awareness of natural egocentric and socio centric tendencies
- Reason unbiasedly through diversity issues

Diversity Education 2016-2017

Introducing Diversity in the Science Classroom

- A Diversity, Epidemiology and social justice unit was incorporated into the Physiology and Disease (PAD, now Pathophysiology) curriculum in Fall 2016
- PAD (now Pathophysiology) is a Biology elective for juniors and seniors at IMSA that deals with changes in homeostasis in the human body and its outcomes, as well as pathophysiology of disease formation.
- The diversity unit was integrated into the nervous system unit because this seemed to be the best fit in the curriculum.

Diversity Curriculum

In 2017, additional discussions were held on equity in education. Students who were otherwise reserved were encouraged enough to express their views, and everyone appreciated the fact that they had been included.

In 2018, students held discussions on LGBTQ+ and equality in social situations. Students brought up many real life case studies in their discussions and debated on the “right” way to deal with gender identity and sexual orientation. This was a sensitive topic in the classroom but students had no hesitation to voice their opinions.

Diversity Curriculum (continued)

In 2019 and 2020, students got more vocal in expressing their opinions. They discussed equity in the classroom, school and the country, as well as the world. In addition to the topics previously discussed, they also talked about ethics in medicine such as the use of stem cells, designer babies and organ transplants.

Diversity Curriculum Logistics

- Students were given diversity topics and were provided with an introduction, rationale, recent events and a list of readings for these topics.
- They were required to synthesize the information with more recent events and create a short presentation building specific case studies for discussion with their peers.
- Emphasis was placed upon discussions dissecting the ethics and moral dilemmas of recent events in the light of the background provided.

Diversity Curriculum Logistics (cont'd)

- Class sections of 20 students each were provided with background information and asked to present to each other during the 100 minute class
- Students brought up many interesting views but were united in their thinking of right and wrong
- This was very noteworthy considering the fact that they were all from different backgrounds and diverse cultures.

Diversity Discussion Topics

Some of the topics discussed included:

- Brain preferences in terms of diversity
- Social and cultural influences on Diversity Thinking
- Diversity Development in the Brain
- Early development of diversity thinking
- Social justice and epidemiology
- Selective Treatment in Hospitals Based on Race

Student Reflections on Diversity Discussions

- Students independently incorporated cases of social injustice against people of color into every single topic discussed.
- Students discussed causes for social injustice such as disparity in income, lack of education, and lack of tolerance toward people of other races.
- An interesting case study discussed was that of identical twins brought up in different environments, one tolerant and the other not tolerant toward people of color, and following their path through adolescence and adulthood.

Student Reflections on Diversity Discussions (cont'd)

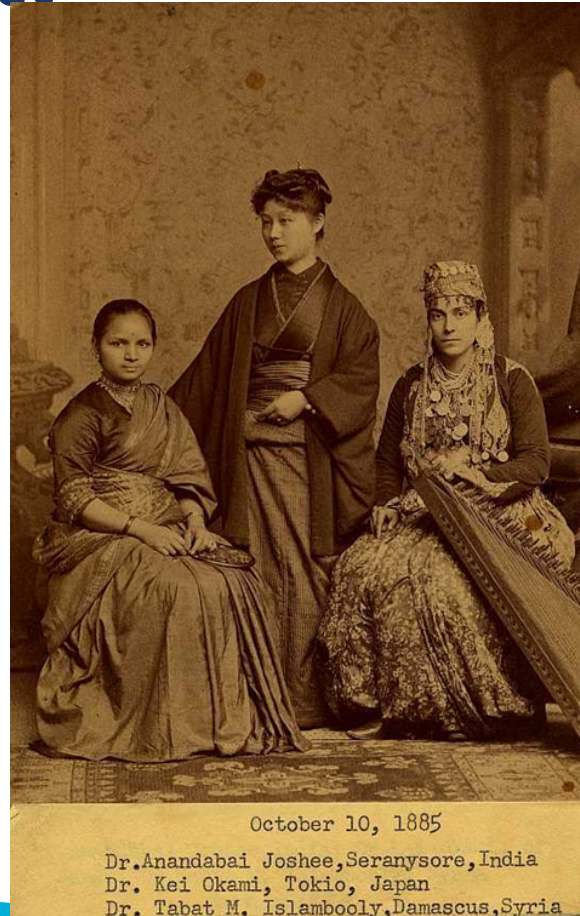
- Their discussions brought forth many aspects of diversity that enhanced their learning by integrating real life experiences.
- Students appreciated the opportunity to speak their thoughts about topics they cared about in the safe space of the classroom.
- Students were able to recognize their own biases yet all their discussions were very respectful.

Diversity Education 2017-2018

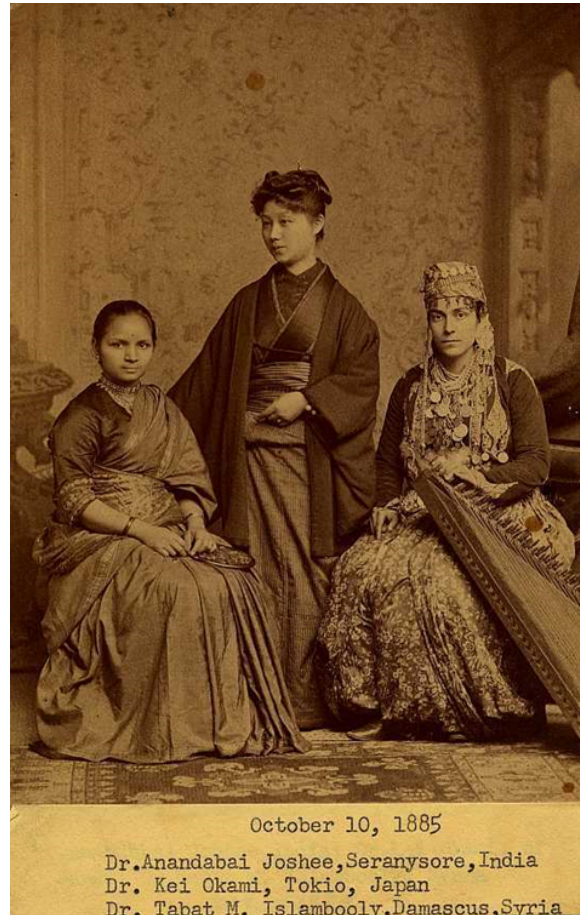
History of Diversity in Pathophysiology

- In Fall 2017, students were introduced to additional diversity awareness through an awareness of the history of development of physiology and medicine.
- Special emphasis was placed upon social, racial and gender barriers.
- Students presented information from scholarly papers provided to them to set the background.
- They then discussed the situations presented and took sides voicing their opinions.

Why is this photograph significant?



First Women Physicians in World History



<https://s-i.huffpost.com/gen/1072427/images/o-WOMEN-DOCTORS-1885-facebook.jpg>

Firsts in History

- Three women, each the first woman from their respective country to graduate with a medical degree, made history when graduating from the Women's Medical College of Pennsylvania in 1886.
- What were the circumstances that led to these historic events?
- How has diversity impeded or enhanced medical education?

Recognize this photograph?

School Segregation Banned, the *Topeka State Journal*. Courtesy Kansas State Historical Society

STATE THE TOPEKA JOURNAL
By Starline Publications, Inc.
Topeka, Kansas, Monday, May 17, 1954—Twenty-four Pages
Official City Paper
Home Edition
FIVE CENTS

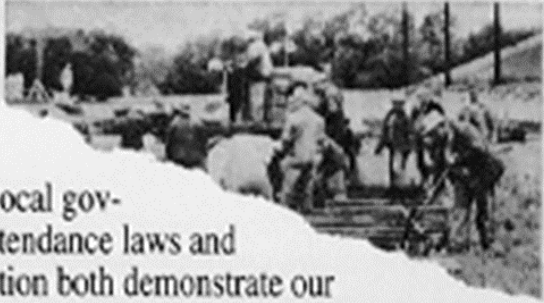
SCHOOL SEGREGATION BANNED

Supreme Court Refutes Doctrine of Separate but Equal Education
High Tribunal Fails to Specify When Practice of Dual Schools Must Be Dropped by States
Washington, May 17 (AP)—The Supreme court ruled unanimously Monday that segregation of Negro and white students in public schools is unconstitutional. But it said it will hear further arguments this fall on how and when to end the practice.
Three easy weeks —
—page — there — time will —
—before the historic —
—see out —
Court Ruling Hailed
Integration Already Ending
School Officials
Topeka Board of —
—ruling —
—time de—

“Today, education is perhaps the most important function of state and local government. Compulsory school attendance laws and the great expenditures for education both demonstrate our recognition of the importance of education to our democratic society... WE CONCLUDE THAT IN THE FIELD OF PUBLIC EDUCATION THE DOCTRINE OF 'SEPARATE BUT EQUAL' HAS NO PLACE. SEPARATE EDUCATIONAL FACILITIES ARE INHERENTLY UNEQUAL.”
Oliver L. Brown, et al. vs Board of Education of Topeka, Kansas, United States Supreme Court, May 17, 1954.

Turnpike Bonds
Arrived So

FOLKS AND THINGS
By 2054 This Bill Should Be Terrific
A KENTUCKY man couldn't be certain that a Southern school system would ever be as good as the one he would be attending. He was a Kentuckian, after all.



Brown vs. Board of Education, 1954



<https://www.archives.gov/publications/prologue/2004/spring/brown-v-board-2.html>

History of Education

- Education has always been a privilege. Most of us do not realize this.
- Opposition to the implementation of diversity and social equality has littered history.
- The Brown vs Board of Education (1954) is an example of protests to remove impediments to education.

Who is this?



Selma to Montgomery March, 1965



<http://www.history.com/topics/black-history/martin-luther-king-jr/pictures/martin-luther-king-jr/mlk-1965-selma-montgomery-march-3>

History of Education

- Civil rights were not always available to all. This is hard to fathom under present day circumstances
- There has always been severe opposition to the implementation of social equality
- The Selma to Montgomery March (1965) is an example of protests to remove impediments to civil rights.

History of Inventions

- Many modern inventions and improvements were conceived under circumstances that included dire poverty and social inequality
- Examples are
 - George Washington Carver (peanut farmer and inventor)
 - Otis Boykin (constructed resistor and control unit for pacemaker) and
 - Garrett Morgan (invented a breathing device, hair straightener and automated traffic signal, also famous for his heroic rescue of workers trapped in a water intake tunnel in 1916, 50 feet below Lake Erie)

Student Discussions on History and Inventions

- It greatly benefitted students to be aware of the diversity, or lack thereof, of the times when these inventions and discoveries were made
- They better appreciated the circumstances of these discoveries and their modernization
- Students focused on specific events in the history of education and medicine and led short discussions on
 - the ethics of the decisions made
 - the modern reaction to these events and
 - how knowledge of these events might improve their education and social awareness of justice and equality

Diversity Education 2018-2019

LGBTQ+ Discussions 2018

- Students were encouraged to discuss LGBTQ1+ awareness in social situations
- Students pulled up specific case studies from recent news to discuss in class.
- Students showed no hesitation in discussing these topics and felt safe in voicing their opinions on gender identity and sexual orientation

LGBTQ+ Activity

- Each person
 - picks a colored paper out of the hat
 - finds others who picked the same color
 - discusses their topic in their small group
 - gets together to discuss as a large group

Diversity Education 2019-2021

Medical Ethics and transplants

- Students discussed the ethics of
 - Stem cells
 - Organ transplants – face, liver, head
 - Right to death with dignity
 - Recent events showing selective treatment in hospitals
 - Education ethics – selective admissions
 - And much, much more!

Next Steps

- The success of this project has set the stage for development of diversity curriculum for other disciplines and other schools in the state of Illinois
- The ease of inserting this unit into an advanced biology course is encouraging and suggests that incorporation into other disciplines should be a smooth transition
- Students greatly benefit by relating to and thinking about diversity with respect to their learning
- Steps are under way to further develop this curriculum and train other educators to do the same in their academic institutions

Diversity in STEM Outreach

- I have presented my work at national conferences such as EB, NSTA and NCSSS and local conferences such as IAGC and Multi-County Institute Day
- There has been good reception and discussion to my work from educators at these conferences, who have contacted me asking how to implement diversity education into their classrooms
- Work is under way to document these classroom experiences in a publication

How can you add diversity into your workspace?

- What thoughts do you have?
- What questions arise for you?
- What resources would you need?

Please contact me at sanjur@imsa.edu

I am always happy to help!

Any Questions?



Thank you for listening!

