
Scientific Justice: A Brief Guide to Social Justice in a Science Classroom

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Abstract: This paper seeks to examine the issue of social injustice in the scientific community and calls for measures to bring social justice to classrooms. It is increasingly becoming a popular part of society in the 21st century. So it is no surprise that social justice should also find its way into the science classroom. This is a very emotional and deep topic to discuss, especially if the discussion is to take place in a classroom. In this article, the focus will be more on helping children understand the complex history of injustices in the scientific community. The students need to contextualize why social justice is important and how we use social justice to avoid repeating the mistakes of our past.

Critical Race Theory is used as a model for the analysis of racial myths and prejudices and their subsequent impacts. The research paper explores various peer-reviewed articles that provide a brief historical account of the issue. Based on the qualitative data, the study outlines some much-needed reforms. Social Justice discussions will also help children challenge their internalized prejudices.

By addressing these prejudices, they may be able to invent better technology in the future. Talking to students about their privileges, whether it is by ethnicity, by wealth, or by gender, we can make sure that students are more empathic and understanding of the struggles of their peers. Students aware of social justice through discussions and classroom activities can be instrumental in creating a more safe and constructive working environment for everyone. This article will give other science teachers like me a starting point to frame their discussions and activities around social justice in the science classroom.

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SCIENTIFIC JUSTICE: A BRIEF GUIDE TO SOCIAL JUSTICE IN A SCIENCE CLASSROOM

Introduction

The classrooms of today are more diverse and inclusive than ever before in history. But we still have a long way to go if we are to correct the mistakes of our past and make a brighter future. It should come as no surprise then that there is importance in educating young students on Social Justice. Especially in science classrooms today, students are considered as temples of reason and rationality.

A conversation about Social Justice in the classroom demands that we talk about the history of injustice, how scientific racism was used to justify bigotry, how privilege plays a role in STEM, and the importance of recognizing inherent bias in your work. These are just some of the few ways to approach a discussion into social justice in the context of a science classroom.

This article uses Critical Race Theory for theoretical and interpretive analysis. This theory argues that the problem of racial segregation or gender discrimination is one of the tough-to-grapple issues because of historical bases such as the practice of slavery and patriarchy.

Sadly, there is a great dearth of literature that explores the injustices in the scientific community. The gap looks especially scarce when dealing with social justice in classrooms. In today's world, fundamental human rights have become even more important and the world is trying to dismantle all forms of racism, prejudices, and hatred. Therefore, this paper is highly important since it touches upon these crucial themes of social justice in the academic and scientific fields including classrooms.

Critical race theory is a theoretical and interpretive mode that seeks to examine the underlying causes behind the racial tensions across the globe. Inspired by writers and thinkers such as Sojourner Truth, Frederick Douglass, W.E.B. Du Bois, Martin Luther King, Jr., this theory was developed in the early 1970s. The model not only takes into consideration the main reasons behind racial myths and subsequent segregation but also understands the perspective of the victims of systemic racism.

The first important point of Critical Race Theory is that race is a perennial issue that has been substantiated by recent historical events such as the Atlantic slave trade. The theory suggests that perceptions formed from time to time are not easily dismantled. Therefore, a constant struggle is required to redress the issue.

Moreover, the theory suggests that one must never acquiesce in arrangements that are racial or hateful. Crenshaw et al. (1995) in "Critical Race Theory: The Cutting Edge," say "Our social world, with its rules, practices, and assignments of prestige and power, is not fixed; rather, we construct with its words, stories, and silence. But we need not acquiesce in arrangements that are unfair and one-sided. By writing and speaking against them, we may hope to contribute to a better, fairer world" (Crenshaw et al., 1995). Therefore, the solution lies in dismantling the racial myths and prejudices and giving equal opportunities to all people regardless of gender, ethnicity, or race.

Discussing the Brief History of Injustice in Scientific Community

Contextualizing is a very important tool at the teacher's disposal. By contextualizing the lesson and discussing it with real examples, we can have a more meaningful impact on the students (Perin, 2011). To start a discussion on social justice, first, we must look at the history of injustice

that has plagued the scientific community for centuries. We must illustrate for our students, and this article may serve as a guide for other science teachers like me to start drawing the picture for them.

Let us start by painting the scene for them in an 18th-century university Lab, or a scientific society lounge, or even a university classroom in Europe or North America. It is full of predominantly white men. As the scientific method matured and scientific practices were refined over the years, the wonderful world of science was still reserved for men. This was not by chance but by design. According to Critical Race Theory, the current racial tensions are a fruit of trees sown centuries ago. In North America and Europe, racism is more pervasive because of the slave trade through Atlantic from 16th to 18th century.

Men, particularly white men in the west, were gatekeeping science not only in the classrooms but in the labs, in seminar halls, and in scientific societies. Making hurdles and barring entry for anyone that didn't look like them was a practice of the norm. Considering this, Critical Race Theory looks relevant because it tends to focus on the historical perspectives. Human society has largely remained patriarchal and male-centered. Women were considered intellectually inferior who could not make great inventions or discoveries. This gender prejudice is quite evident because men (especially whites) have surrounded scientific community and science classrooms.

To start a discussion on Social Justice with students, it is pertinent to discuss the history of exclusivity and bigotry that has plagued the scientific community and institutions. Women, people of color, and members of the LGBTQ+ were considered inferior, not smart enough, or outright less than humans to be included in the scientific community (Carlton, 2020). This resulted in minorities not being awarded admissions into universities (Dominus, 2019), not being credited for their work, and even their researches being dismissed on the sole fact that it wasn't authored by white men. Nonetheless, history has countless examples of relentless women, people of color, and members of LGBTQ+ contributing to science. Here are some examples that will help students understand the hardships extraordinary scientists faced when all they were doing was trying to make the world a better place.

Take the example of Marie Curie, a chemist from Poland that won the Nobel prize two times: once for Physics and once for Chemistry. Even after significant recognition of her work, she faced blatant sexism during her work. She was never seen as an equal by her male colleagues. There were even numerous rumors that were spread around to discredit her work. In the world of mathematics, Srinivasa Ramanujan is a well-known name. Ramanujan was a self-taught mathematician from India, who through his brilliance and ingenuity earned his way into the University of Cambridge and later became a fellow of the Royal Society. During his lifetime he compiled more than 3900 identities and equations and most of them have been proven true. His contributions to number theory and fractions are still of significance today, yet most of his colleagues never truly considered him an equal and made hurdles for him whenever possible, just because of the color of his skin.

Alan Turning is another tragic example, he was an English mathematician working for the crown during World War II. He made significant contributions to cracking vital coded German messages and made an electromechanical machine to break the infamous German Enigma code. His work not only saved thousands of lives during World War II, but his contributions to theoretical computer science and artificial intelligence are still relevant today. To this day, programmers use the Turing test to judge if a computer program is capable of thinking like a

human. He was prosecuted by the British government for being homosexual, and would later commit suicide. These are just a few of the many injustices embedded in the history of scientific pursuit.

These are just a few examples that can be discussed with students about how in the last few centuries, a culture of exclusivity, bigotry, and xenophobia has dominated the scientific community. We never truly know the damage this culture has done to our scientific knowledge, but we can only imagine how many students were discouraged from pursuing science due to this culture. Now we can only recognize the failures of our past so we may make a better future. Critical Race Theory again becomes relevant as it gives special focus to socio-psychological and economic challenges of the victims. The theory says that victims face far more challenges and bore potential losses than the common perception.

Students in a science classroom must be aware of the history of bigotry, sexism, and xenophobia in the scientific community; so that they may foster a better community for future engineers, scientists, and biologists.

What is Scientific Racism?

The term scientific racism refers to the set of beliefs that indicate there is empirical evidence to support racism (Salter, Adams, & Perez, 2018). Such beliefs are based on pseudoscientific claims that there are direct relations between intelligence and race, implying some races are more intelligent and thus more superior than others.

Books like the Bell Curve perpetuate these harmful beliefs and provide evidence to further validate racism and bigotry. Surprisingly this is a very recent publication, making the conversation with students about scientific racism all the more pressing. There has been a plethora of research published supporting these unscientific claims, which upon closer inspection were a result of skewed data, doctored data, and overall bad scientific practices (Glymour, 1998). The critical race theory argues that racial biases are often substantiated through legal and academic means. It means the system will favor one race and neglect others. Another way will be to become intellectually dishonest and become one-sided to support or malign any one race.

Scientific racism is an important topic in a science classroom. We can start this conversation in a classroom by talking to them about the history of using bad science to justify xenophobia. Sharing examples or case studies of such pseudoscientific reports with students will help them identify scientific literature that is based on bad science and is biased. If we are to prevent repeating the mistakes of our past, we must hold these difficult conversations with our potential scientists of the future.

How to address privilege in the Science Classroom

Talking about privilege is a difficult topic, and it's an especially difficult topic to discuss in a classroom, but it's a much-needed conversation for a science classroom. Talking to students about privilege early on helps them develop a mature emotional point of view about how social bias can give them an advantage or disadvantage in the real world, and in our context the scientific community.

Even though the scientific community, on the whole, has made large strides towards equity in the last decades, it is still far from perfect. Let's take the example of women in STEM, that is

Science Technology Engineering and Mathematics, women make up 52% of the total workforce – yet they only account for 27% of the workforce in STEM. These are alarming statistics and if they are to be improved, progress needs to be made at an elementary level (Anthony & Cheridan, 2021).

Science students need to be educated about the hardships and challenges that their classmates (of different gender, race, or ethnicity) face in the STEM community. If they are aware of these hurdles, they will be in a better position to act as allies to their peers. Students must also be educated about how not all the students in America have the same opportunities as them. Not all schools get the same amount of funding, resources, and quality of education. Thus by being aware of the fact that other students may have it worse than them, will help them to be empathic and understanding of their peers in future life.

The role of Bias in Science

Recent developments in Artificial Intelligence have created a very unique problem, our personal bias leaking into the algorithms. Educating students about our internalized bias and prejudices is critical in preparing more responsible engineers and scientists of the future. For a moment, consider the importance of modern AI algorithms, which are in everything we use in the modern world from sorting job applicants to helping create jury lists for courts, they touch our lives in a very real way.

A recent example is of a ProPublica report that looked at a criminal sorting algorithm called COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) developed by Northpointe, Inc. This algorithm was being used to predict which defendants were more likely to become a recidivist – criminals that commit a crime again. ProPublica analyzed over 10,000 criminal defendants in Broward County, Florida, and found that the algorithm was twice as likely to mark an African American to potentially recommit a crime than they did for white defendants (Larson et al, 2016). We have to make the students understand that these technologies are created by humans. Thus they are bound to contain personal biases and prejudices. Human judgment is still needed to help Artificial intelligence's decision-making fair (Silberg & Manyika, 2019). By talking to students about problems we can create by our unchecked prejudices and training them to make better decisions, we can create better technology.

Science teachers can help students recognize their internalized biases, so they are better aware of the technologies they create. Technologies that have a real impact on real people. By holding discussions on a case study of real-life examples and doing exercises to identify personal prejudices, science teachers are making the technology of tomorrow safer and more inclusive.

What role do Science Teachers Play in Social Justice?

Science teachers are the first point of contact for students to the scientific community at large. Teachers act as representatives and role models for the students and aspire them towards greater aspirations. They are responsible for encouraging young students to think of a STEM career. Science teachers should also be the first ones to introduce them to the importance of social justice in the scientific community. By introducing them to complex topics such as internalized prejudice, sexism in STEM, racism in the industry, and scientific racism; we can make sure they improve the scientific community from within.

By boldly encouraging discussions on pressing issues like sexism in STEM careers, internal prejudices impacting important decisions, and unconscious bias skewing results, science teachers will prepare a more informed, more aware, and more empathetic scientist.

Where to get started?

There are plenty of ways to make education on Social Justice in a science classroom fun and engaging for the students. You can start by asking students to research and prepare a presentation on an underrepresented scientist and talk about the significance of their contributions to science. This will allow the students to connect more deeply with historical scientific figures and learn something new.

Another way to engage the students can be by holding various theme days. For example, one day everyone could discuss scientists of Asian heritage, the next there could be a discussion about women scientists. This will be a fun way to discover new scientists and will provide an opportunity to give students new role models to look towards. More importantly, activities such as these will make them realize that science is for anyone and everyone. Helping students realize that bigotry is not only bad for a functioning society but also goes against the scientific method. Science teachers can do this by showing them examples of researches and studies heavily influenced by personal prejudice. Many researchers were blinded by their hatred and prejudice that they doctored their studies to show results in line with their beliefs. By showing students how harmful this can be, it may make them realize the importance of social justice not only in the classroom but in the real world as well.

Closing Remarks

Racial prejudice and social injustice in the scientific and academic community has long remained a daunting challenge. Racial segregation and social discrimination is a perennial issue and will take many more years to dismantle it. Science classrooms are located in the real world and thus are subject to their problems. So, it's no surprise that talking about social justice issues and how we can make a better community for everyone is important in STEM.

This paper offers a much-needed insight into the issue of social justice in classrooms as very limited literature is available. This research employs Critical Race Theory for theoretical and interpretive analysis. This theory argues that the problem of racial segregation or gender discrimination is one of the tough-to-grapple issues because of historical bases such as practice of slavery and patriarchy.

By helping children to respect, acknowledge and empathize with their peers, at an early age, in the context of science goes a long way into making them into better humans of the future.

The need of the hour is to bring social justice in classrooms for a more peaceful and prosperous future. No form of prejudice or discrimination should find a place in science classrooms, either based on gender or grounded in racial hatred.

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