Mitigating Challenges Faced by Women of Colour in Physics

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Scientia

MITIGATING CHALLENGES FACED BY WOMEN OF COLOUR IN PHYSICS

Women of colour face many obstacles in their pursuit of STEM education and employment, especially in the field of physics. **Dr Apriel Hodari**, Principal Investigator at Eureka Scientific, and **Dr Angela Johnson** of Saint Mary's College of Maryland, have been working on strategies to remove these barriers. Their solution involves significant cultural change within an institution, catalysed by strong leadership at the top.

Shortfall of Women of Colour in Physics

A document prepared by the US National Science Foundation in 2017 reported on the current situation for minority groups in STEM-related fields of study and employment. In summary, the report highlighted that women, persons with disabilities, and three racial and ethnic groups – African Americans, Hispanics and Native Americans – are significantly underrepresented. While the number of individuals from minority groups receiving university degrees has increased, there is still a major shortfall, especially in the STEM workforce.

Consider, for example, the area of physics. Women of colour received less than 4% of all physics degrees between 2004 and 2014, despite constituting 22% of all US citizens and permanent residents aged 18–24, and 16% of all bachelor's degree recipients. As far as the physics workforce is concerned, even though the number of women earning degrees in physics is increasing, the proportion of women in this field (20%) is the lowest of all the physical sciences. These are, indeed, worrying statistics.

Two of those taking action to remedy this situation are Dr Apriel Hodari, Principal Investigator at Eureka Scientific, and Dr Angela Johnson, Professor of Educational Studies at Saint Mary's College of Maryland. Both are experts in the field of STEM educational research, especially that pertaining to equity and workforce diversity, and the culture of STEM disciplines. The focus of their recent work has been understanding the institutional cultures and environments that are contributing to the disparities between white and black, male and female, in the field of physics. Their ultimate goal is to improve the representation, progression and success of minority ethnic staff and students within higher education.

Moving Away from the Deficit Model

On a fundamental level, Dr Hodari and Dr Johnson feel that educational institutions need to move away from what is known as the 'deficit model' of education. One source explains that the deficit model of education is a perspective that attributes poor achievement to a lack of effort or a deficiency in the individual, rather than to failures of overarching social

and educational systems. Locating deficiencies in the students who drop out, rather than the institution, makes it difficult for institutions to take any actions to correct the problem. This approach essentially treats the symptoms of college dropout, not the actual cause.

To correct this, there needs to be greater emphasis on the broader cultural elements within an academic community, especially those that are negatively impacting the study and work experiences of women of colour in physics. Up until now, however, it has been easier to shift scrutiny and blame from the failures of educational institutions themselves to the student. Many issues arise when the finger of blame is pointed based on superficial, biased or inaccurate assumptions about the racial and cultural backgrounds of the individual student. A recipe for disaster, indeed.

On the other hand, as Dr Hodari and Dr Johnson point out, people from different ethnic backgrounds have different experiences during their journey through higher education, and they connect with it in different ways. All individuals have multiple identities, and the intersection of those different identities should be considered wherever possible, especially when analysing data and developing strategies to promote the retention and success of women of colour. In summary, we need individualised support, not assumptions. An understanding of the challenges that women of colour face is also paramount.

Exploring the Challenges Faced

In research of 2017, Dr Hodari, Dr Johnson and their colleagues highlighted that between 2002 and 2012, only 1% of graduating physics majors were Black women and another 1% were Latinas. Moreover, only 61 Native American women completed degrees in physics in those years (out of 48,000 physics majors). So, to address this, the team wanted to find out the specific challenges faced by women of colour in physics education. They hoped that this would, in turn, inform cultural and institutional-wide remediation efforts.

The team's approach involved looking at real-life instances where women of colour were both struggling and thriving, and the characteristics of the department and study environment that was contributing to this. Their method of choice was qualitative: including open-ended interviews and ethnographic field notes. Given their disciplinary overlaps with physics, the studies included participants from fields with similar underrepresentation of women of colour, namely, astronomy and astrophysics. Additionally, the work benefitted from previous research in mathematics, computer science, and engineering.

Stereotypes, Isolation and Microaggression

Prior research by Dr Hodari and Dr Maria Ong into the experiences of women of colour in physics revealed a challenge: the activation of stereotypes and resulting feelings of isolation. Put simply, academics and fellow students tended to associate science with white males, not women of colour. While that may seem to be rather callow reasoning, it permeates the attitudes of many in educational institutions and the STEM workforce today. This attitude, in turn, affects the way professors and fellow students unconsciously view the potential of women of colour for success, and they treat them accordingly.

These stereotypes perpetuate feelings of vulnerability and isolation in the student. It snuffs out their self-belief. The research team found that many students felt judged on their appearance and background – that they had no right to be studying physics. Many also expressed being afraid to ask questions in class or go to professors for help, for fear of reinforcing negative stereotypes towards women of colour. To further compound the issue, as those interviewed were often the only women of colour in their physics class, they could not even turn to their peers.

Many participants in the study also reported that they had been subject to instances of what Dr Hodari and Dr Johnson refer to as 'microaggression'. Sue and colleagues define microaggression as 'subtle indignities, slights or insults directed

at individuals, consciously or unconsciously, because of their race or gender'. In most cases, the hostility stems from bigoted and racist beliefs on the part of the aggressor. Researchers have found that women of colour who had been subjected to this treatment experienced feelings of loneliness and inadequacy. Needless to say, these experiences negatively affected their engagement with their studies.

Evidence-based Solutions

Many of the participants in Dr Hodari and Dr Ong's study highlighted that having a counterspace – a setting where they could find validation, vent frustrations about racism and sexism, and express both their identities as scientists and as women of colour – was vital to overcoming the challenges they faced. Counterspaces can take many forms – from student groups and mentor relationships, to conferences and enrichment programs. Essentially, counterspaces are any locations, events or forums that give women of colour a voice.

It is also important to note that these counterspaces can be found within departments. In prior research, Dr Johnson has found that professors who focus on developing an inclusive community can turn feelings of isolation into feelings of belonging. They can do this by creating opportunities for students to interact outside of class time and to work together. In a more direct sense, faculty can directly address microaggressions that come to their attention, by rejecting any stereotypes that are brought up, directly affirming that women of color belong in their departments and insisting that microaggressions end. And finally, the teaching strategies of educators can do much to address negative stereotypes and anti-social behaviour. It is vital that professors create learning environments designed around the needs of those from underrepresented minority groups.

Conclusion

The shortfall of women in physics and the physics workforce certainly is a cause for concern. Dr Hodari and Dr Johnson's research has shed light on many of the challenges faced by women of colour that are contributing to this shortfall. Primarily, women of colour face active stereotypes, isolation and acts of microaggression from both teaching staff and fellow students. This hinders their success because it tears down their identity and self-esteem. It negatively impacts upon their confidence and self-belief. Many give up. Or worse still, many young women feel discouraged from beginning their studies in physics in the first place.

Two of the main solutions to these problems include providing counterspaces and making faculty adjustments to stimulate an inclusive community. All of this is underpinned, not by the deficit model of education, but rather, turning the spotlight on STEM institutions and what they are doing to promote diversity and acceptance.

To this end, Dr Hodari and Dr Johnson have teamed up to locate universities where women of colour are thriving, to study how these institutions have created counterspaces or taken action to reduce the isolation and microaggression experienced by women of colour. They have already identified several institutions that are graduating surprisingly high numbers of women of colour in physics, and are currently identifying institutional policies and practices at these institutions. In the future, they hope to identify more of these exemplars and form a network of physics departments committed to becoming exemplars themselves.

In conclusion, the research of Dr Hodari, Dr Johnson and their colleagues has found that women of colour, over the course of their careers, face a consistent set of difficulties related to their race and gender. However, where supervising professors supported their learning and careers, and implemented measures to adjust the culture within the department, many of those challenges were mitigated.

Meet the researchers

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Dr Apriel Hodari received her PhD in Physics from Hampton University in 1998. Following this, she was appointed as Postdoctoral Fellow of STEM Education with the US National Science Foundation (NSF). After several posts in industry, she was appointed Principal Investigator at Eureka Scientific, Oakland, California in 2014, where she currently serves. There, she co-leads research collaborations investigating the inherent cultures of inclusive STEM departments and seeks to learn from the experiences of women of colour in the fields where they are most underrepresented.

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Dr Angela Johnson received her PhD in Social Foundations of Education from the University of Colorado in 2001. Dr Johnson is an experienced physics teacher and researcher. After teaching physics and later teacher education at both school and college level for many years, she was appointed Associate Professor of Educational Studies, at Saint Mary's College of Maryland. She was later promoted to Professor and Department Chair of Educational Studies at that same institution, as well as Director of Teacher Education. Like Dr Hodari, her research focuses on addressing the challenges that women of colour face in physics education and the STEM workforce.

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ACKNOWLEDGEMENT

Our profound gratitude to Maria Ong for co-leading several projects that preceded the work highlighted in this article. The current work is supported by the National Science Foundation under Grant No. DUE-1712531; as well as the Fulbright Scholars Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation, Fulbright United States-United Kingdom Educational Commission or the Council for International Exchange of Scholars.

FURTHER READING

A Johnson, M Ong, LT Ko, J Smith and A Hodari, Common Challenges Faced by Women of Color in Physics, and Actions Faculty Can Take to Minimize Those Challenges, The Physics Teacher, 2017, 55, 356.