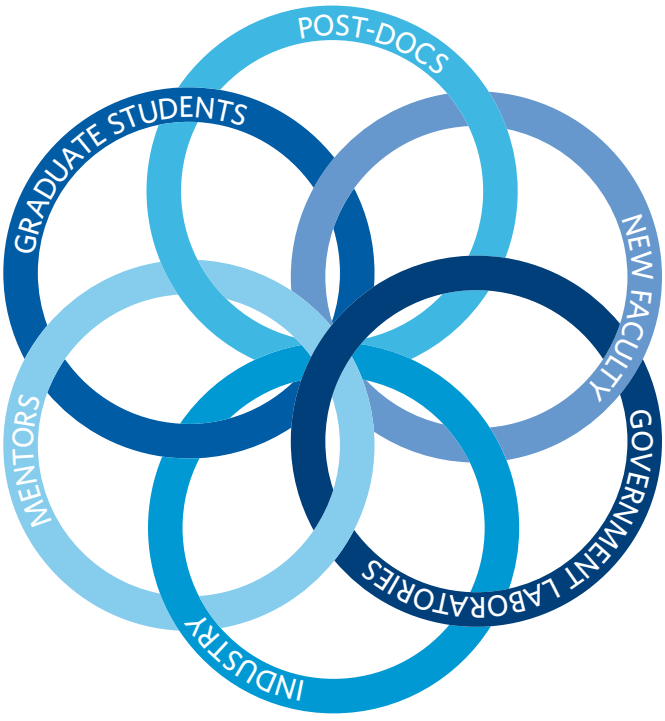
The Early Career Section offers information and suggestions for graduate students, job seekers, early career academics of all types, and those who mentor them. Angela Gibney serves as the editor of this section. Next month's theme will be expanding your teaching repertoire.



Opportunities For Diversity in the Classroom

An Opportunity for Inclusion: A Course in the History of Mathematics that Includes Mathematical Contributions of Non-European Culture

Candice Price

Motivation

Throughout the course of history, mathematics has changed the way people view the world. A course in history of mathematics is a cross between a history course and a mathematics course, drawing on sciences, anthropology, sociology, and the languages, where assignments focus on writing rather than problem solving. In many American colleges and universities, this course only highlights the contributions of individuals with European roots, with an overwhelming number of them identifying as male. While this exclusion of important narrative supports the incorrect and naive view that other cultures did not contribute to the growth and expansion of mathematical thought, it also creates a cultural idea of what a mathematician looks like: white and male. As a Black woman, I understand the age-old issue of imposter syndrome and the phrase "we cannot be what we cannot see." Because of this, I sought to create a course that included a critical look at the "culture" of the mathematics community in America while also highlighting the contributions of cultures and people outside of the Eurocentric gaze.

The year before planning to teach a History of Mathematics course at the University of San Diego, my home institution at the time, I discussed the course with Gail Tang, who was teaching the course at the University of La Verne. Tang shared several resources including the book *The Crest of the Peacock: Non-European Roots of Mathematics* by George Gheverghese Joseph. While looking through several

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resources as possible material for the course, I centered the flow and narrative of the course around this text.

Designing My Course

A history of math course can be taught in many different ways. One path can be to focus on the chronological history of mathematics starting with the mathematics of ancient civilizations and ending at the beginning of the 19th century. Or one's course can take a biographical viewpoint and cover the contributions of well-known mathematicians. But without a concrete plan for inclusion, these two paths can often lead to a course with little to no discussion on the contributions of women and non-European mathematicians.

To mitigate the erasure of contributions from minoritized groups in mathematics, I consciously mapped out my course objectives to make sure that inclusion and diversity were included in my pedagogy. Thus, based on an email thread and conversations with Ron Buckmire, Omraya Ortega, and Gail Tang about readings for their history of math courses at their respective institutions, I mapped out a plan for how the course would go. One of my learning outcomes/goals for this course was to include discussions on the culture of mathematics from anthropological and sociological viewpoints. I also decided to focus on mathematical contributions of cultures outside of the Eurocentric viewpoint.

As a mathematician whose primary research area is not math history, I was able to learn along with the students and engage with them in meaningful discussions. As a Black female, I was inspired when learning about the contributions of Africans to mathematics.

Designing a Future Course

While I truly enjoyed teaching this course, there is always room for reflection and improvement. Building on the way I taught the course previously, I would continue to utilize *The Crest of the Peacock* as the primary text while adding course readings from other books as well. *Mathematics Across Cultures: The History of Non-Western Mathematics*, edited by Helaine Selin, is a collection of short articles on the mathematical contributions of various cultures and includes discussions of mathematics through the lens of anthropology and communication studies. One popular textbook that would be useful for its exercises is Victor Katz's *A History of Mathematics*, especially those exercises in the first chapter on Ancient Mathematics. Other texts that could be included are *Africa and Mathematics: From Colonial Findings Back to the Ishango Rods* by Dirk Huylebrouck, which includes the rich history of mathematics across the African continent and African cultures, and *The Universal History of Numbers: From Prehistory to the Invention of the Computer* by Georges Ifrah, which has beautiful illustrations and is centered around mathematical tools and counting.

Because my course is designed as a discussion-based writing course, integrating the areas of anthropology, history, languages, and mathematics, the course can benefit from the inclusion of lectures by scholars of the civilizations and communities that the course features. The hope is that these scholars will share with the students what these communities were like during the time the mathematics being highlighted was developed and discovered.

In my previous course, I included a guest lecturer during the sections discussing contributions of African cultures to mathematics. African History scholar T. J. Tallie guest lectured and taught the students how to count and say common phrases like "Hello" and the days of the week in isiZulu. Tallie also discussed with the students how colonization impacted the mathematics of different parts of Africa. For example, the introduction of written language led to some spoken words being lost or having their meaning changed. While I know this is not limited to just mathematics—Tallie shared a great anecdote with us about how there was no word for "Sunday" but that one was created to mean "the day you go to church"—one may never fully know what mathematical knowledge was forgotten or hidden or lost. Yet, what must be realized is that even though originally spoken information may be lost, this information may still have an impact as a reference in other words or works.

George Gheverghese Joseph puts wonderfully into words what can be felt at the end of a course of this nature: "As our knowledge develops, differences in historical perspectives emerge. And to this extent that different views of the past affect our perception of ourselves and of the outside world, history becomes an important point of reference in understanding the clash of cultures and of ideas" [3]. Including the non-European roots of mathematics gives all students in these courses the opportunity to learn about and acknowledge these important contributions.

References

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Credits

Author photo is courtesy of Candice Price.

Intersections of Mathematics and Society

Ranthony A. C. Edmonds and John H. Johnson Jr.

Introduction

At the undergraduate level, most mathematics programs and courses don't devote time to discussing how mathematical communities are formed and maintained. Instead, mathematics is often presented as a collection of "eternal truths and objective algorithms" that are discovered (or invented) and simply passed on from one generation to the next. Outside of perhaps one history of math course, little regard is usually given to the larger social and cultural milieu that supports and sustains mathematical communities. We claim this is one—but not the only—reason many students and practitioners feel "disconnected/isolated" in math. This is especially true for Black, Indigenous, and other people of color.

In our course, *Intersections of Mathematics and Society: Hidden Figures* at The Ohio State University, we directly addressed the connection between the creation of mathematics, its developments and applications, and society. We also emphasized the importance of a strong mathematical identity as students try to join, be accepted, and valued as a member of various mathematical communities. To do this, we centered our focus on mathematical community via the *Hidden Figures* text by Margot Shetterly [She16].

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Our effort ties into the larger landscape of instructors using culturally competent pedagogy. Culturally relevant practices are tied to three overarching instructional pillars: (1) academic achievement, (2) cultural competence, and (3) sociopolitical consciousness. While the first pillar is already a staple of the college mathematics classroom, the subsequent two may feel less familiar in a mathematical context.

Culturally competent practices give students a way to develop their own mathematical identity in addition to providing insights into the lived experiences of others within the mathematical community. Sociopolitical consciousness provides students with an understanding of the interplay between mathematics and the social and political issues that impact local communities and the world at large. These perspectives allow for a holistic view of mathematics, where students consider not only the conceptual frameworks that permeate our courses, but the historical and political context in which mathematics is created and used.

In this article, we highlight tips that may be helpful for those considering designing a new course or redesigning an existing course at their institutions so that it incorporates cultural-competent practices. These tips are related to elements of our course that we found the most successful for creating the learning environment we desired, and that can be implemented in any course, regardless of the content. We also describe our hidden figures course in more detail.

Tips for Course (re)Design

In this section we provide tips for course design related to components from our course that were inspired by a focus on the intersections of mathematics and society, and rooted in the three pillars of culturally competent pedagogy highlighted above. We focus on (a) embedding reflection within a course, (b) involving students in outreach and service learning, and (c) highlighting external voices.

Embedding Reflection within the Course

- Intentionally include reflective (or extension) questions in computational assignments. In a calculus course, for example, a question could be included in an assignment about derivatives that asks students to find three real-world applications of derivatives in their major field.
- Consider adding ongoing reflections related to a course theme you want to emphasize throughout the term. (In our course we had several service-learning specific reflections, the first asking students to reflect on their own experiences with service learning along with the potential impact of their outreach on the local community, and the last asking them to reflect on the process of developing STEM programming and on the utility of service learning to increase access to mathematics.)
- Incorporate reflection into the course by utilizing online forums for discussion. Be clear about the