



ACS Grants Program: Final Report Form

Instructions:

- Respond to items 1-7 in no more than five pages.
- Along with your final budget report, submit this document to dmorton@colleges.org (see www.colleges.org/grants/forms)
- Note that portions or the entirety of your final report may be reprinted on the ACS grants webpage, so please indicate any portions that should not be made public at this time

Name of Project Lead: **Viveka Brown, PhD**

Host Institution: **Spelman College**

Project Title: **Teaching Social Justice Mathematics**

Today's Date: **January 9, 2020**

1. **Project summary:** *Briefly describe the purpose, intended goals, and major activities of your project.*

The 2019 Teaching Social Justice Mathematics grant project funded an ACS faculty workshop. The purpose of the workshop/symposium was to expand the number of ACS faculty integrating issues of fairness and equity into undergraduate mathematics lessons and classroom discourses. The 3-day symposium hosted 16 ACS faculty and 3 non-ACS faculty mentors at Spelman College (Friday and Saturday) and Morehouse College (Sunday) in Atlanta, Georgia. The primary goals of the symposium were to: (1) develop and cultivate a community of practitioners who are committed to integrating social justice issues into undergraduate mathematics, (2) facilitate and nurture collaborative research among a faculty community of practitioners, and (3) identify and document promising practices and limitations when integrating social justice issues into undergraduate mathematics.

The workshop started with plenary lectures by the faculty mentors on topics ranging from, for example, integrating mathematics and social justice topics into early college and more advanced mathematics classrooms to instructional priorities and pedagogy. As a result of these presentations, a host of discussions on how to support and develop university-level students' well-being, mathematical learning, and their socio-political consciousness.

An overarching outcome of this project was to help expand the number of ACS faculty who engage in teaching social justice mathematics. As a result, all major activities surrounding around the development and continuation of conversations in small groups. Our project was able to accomplish our primary goals by development small groups by content area during the symposium. These groups supported individual faculty's development of activities and subsequent implementation of these activities at their home institutions. To gather more information about faculty modules, a follow up survey was also sent out at the end of the fall 2019 semester. We provide more information on the symposium's small groups below, as well as the attainment of our primary goals based on the results of the fall survey.

2. **Attainment of goals:**

Explain the steps you took to achieve and evaluate the success of each project goal. Provide details regarding the tools and methods used to measure each goal and the extent to which, based on those measurements, each goal was met.

Goal 1: Develop and cultivate a community of practitioners who are committed to integrating social justice issues into undergraduate mathematics

Three strands of coursework were used to develop groups (*Strand 1: Early College Mathematics, Strand 2: The Calculus Sequence, Strand 3: Statistics and Data Science*). The symposium also included whole group activities to help deepen faculty's understanding of social justice and various educational practices (e.g., curriculum development; course facilitation). Additional group activities including a mock classroom experience that utilized statistical data on learning mathematics with examples of environmental injustices.

In each small group (*Strands*), symposium organizers and mentors used large post-it pads to collect participant data and information related to the project's first goal. The primary objective of the initial small group interactions and conversations was to have faculty reflect on their own experiences and build on their interests within their small groups. Overall, this variety of activities contributed to participants' ability to *cultivate ideas focused on integrating social justice issues into undergraduate mathematics*.

In addition to cultivating ideas, small groups also focused on module/lesson development. Each group had a total of four (4) hours to meet and collaboratively develop their ideas into more practical modules and specific lesson plan ideas. The small groups were used to help accomplish the first goal of the project, and they also allowed faculty members to develop relationships across courses for future research and collaborations.

Goal 2: Facilitate and nurture collaborative research among a faculty community of practitioners

The mathematical focus of each small group helped faculty to *facilitate and nurture collaborative research* in their specific content area. This goal served as an intermediary step in the process leading up to faculty implementing their modules in their courses. The modules that faculty shared amongst each other and at the end of the fall term served as the primary data collection and assessment method to make sense of each group's findings.

Early College Mathematics: In this group, each participant shared information on the individual course in which they would integrate a social justice module. Two sub-groups were formed: one based on topics that are taught in a contemporary math course primarily for non-math majors and another group for developmental math courses such as Intermediate Algebra and Precalculus. Each group then discussed a potential social justice topic. The first group decided to focus on the topic of gerrymandering and the other group discussed body image and environmental concerns. When the small group reconvened the second day, the two groups presented their ideas to each other and suggestions were given by participants for the groups to consider in developing their final activities and modules.

The Calculus Sequence: The calculus group spent their first day discussing and researching ideas and topics that can be included in both Calculus I and II courses. The group listed social justice topics that seemed like they might interest students and worked to determine which of these would have public data available for use in an applied mathematical module. During their second day, participants decided to concentrate on a specific problem

surrounding water pollution given that there are many resources on the Flint Water Crisis. The faculty members conducted additional research to identify specific tools and resources that they could use in their courses for the fall term.

Statistics and Data Science: In the statistics and data science group, participants focused on the various features of statistics courses to identify various “touch-points” upon which activities could be based. Participants split into two sub-groups, with 3 people per group to focus more acutely on specific problems. One of the groups focused on analyzing social media and other student-collected data while the other group centered on data science with a focus on network flow problems. Additionally, discussions were held to help differentiate statistics from data science and identify the type of problems that could constitute social justice activities as well as the ethical uses of data.

Goal 3: Identify and document promising practices and limitations when integrating social justice issues into undergraduate mathematics

As organizers, we analyzed survey data collected from faculty in the Fall 2019 survey. This survey allowed us to *document promising practices and limitations* reported by faculty when *integrating social justice issues into their undergraduate mathematics courses*. Approximately 75 percent of participants responded to the survey and/or submitted modules documenting their experiences. Of all survey responses, we found that the majority of faculty (>90%) attempted to integrate their modules in courses that aligned with their *strand* from the symposium, with a few exceptions (e.g., *Introduction to Modern Mathematics*). Few faculty reported on specific issues with implementing their modules, with most respondent’s rating their skill-level at 3 (some knowledge) or higher (scales ranged from 0 to 5). Some early data of descriptions/outlines of a few sample modules implemented is provided below:

The idea is to look at the rearrests after one year for juveniles convicted of a felony, where one set went through adult court while the second set went to juvenile court. Matched pairs were formed by pairing up offenders based on: prior arrests, age, severity of the offense, background, etc. (the pairing was done by Larry Winner with data from Florida). Considering each pair as a data point, one can build a contingency (or frequency) table and apply McNemar's test to see if there is a statistically significant difference between the two approaches as measured by rearrests (there is a difference, with juvenile courts having significantly lower rearrests).

[This lesson] included an introduction to what apportionment is and students were given an activity to assign representatives to states, at least two plans. Students spent 4-6 mins and then I stop and ask which one was fair? We move on to discuss Hamilton's method and paradoxes. We conclude with the 2010 census and the expected outcome. The last 10 minutes were for discussion on why the citizenship question would have been important. This generated a lot of good discussions. The lesson can be found here:

https://docs.google.com/presentation/d/1sDFayb8sgKrJHxJcUx8fI_pksuH6tpyhHPy8eRFNWaY/edit?usp=sharing. Also, I did a second activity on Gerrymandering (https://docs.google.com/presentation/d/137NC474W-QGIGag6laC_rRm6QmXuWyMNVzx_cxYI2PU/edit?usp=sharing) which I improved after the symposium. However, the apportionment activity was done as a direct result of my involvement in the symposium.

During the symposium, one of the main issues/limitations that came up frequently was “How to discuss issues of social justice in the mathematics classrooms?” Given that our participants were trained as mathematicians or mathematics educators, they did not have many experiences with running a classroom discussion around sensitive topics that could potentially result in a debate. One faculty facilitator, Dr. David Kung, ran a sample class where participants acted as students in his course. Dr. Kung and Dr. Kari Kokka, another mentor, also shared their experiences on how to lead such discussions in the classroom. One of the documents that was shared with the participants was the summary of the “Classroom Norms” which focuses on the following priorities in these discussions:

- Share talk time
- Listen to understand (as opposed to “to respond”)
- Everyone has expertise
- Be present
- Critique ideas, not people
- Assume positive intent

Overall, we found that these structures helped faculty reduce the number of issues that they experienced in the implementation of their modules across campuses. In future work, we plan to collect more focused data on the host of concerns or follow-up questions, for example, that came as a result of implementing various social issues into mathematics courses.

3. Impact of project:

Explain the impact your project had on relevant constituencies (e.g., students), structures, (e.g., a major program), processes (e.g., community engagement), and/or relationships (e.g., consortial partnerships).

This grant project was motivated by a previously-funded ACS faculty workshop—Mathematics for Social Justice—which was held in the summer of 2016. From the first grant project, we found that faculty had some of their initial experiences implementing lessons. For the second project, a few returning faculty sat on a panel (during Sunday’s events) to talk about their experience to the larger group. One participant, Kathy Hoke from the University of Richmond, reported that her work has resulted in students’ increased interest in the subject matter, discussions among faculty (one who also attended the 2016 meeting), and more experience and opportunity for her to share the resources that she has developed.

Overall, as a result of these two workshops, we see growing evidence of a solid network of undergraduate mathematics faculty at ACS institutions that have been working on integrating issues of social justice into undergraduate mathematics across institutions. During the symposium, we also included a session on how to secure external grants to study Mathematics for Social Justice, which will help to inform a more focused impact across campuses. For example, we encouraged our participants to apply for a Diversity and Inclusion Grant from ACS to continue these symposia.

4. Consortial (ACS-wide) value of the project:

Describe how your project results can or will strengthen the institutions that the ACS comprises, e.g., via the dissemination of a final report, the future training of campus leaders, or the building of an inclusive community of practice. See also “sustainability” in Sec. 6.

Many of our participants did not have any prior experiences with integrating issues of social justice into mathematics. After the public lectures by the facilitators and faculty mentors, we used the subject-oriented groups where participants worked on creating teaching modules to increase social awareness in their mathematics classes. These groups help to inform a broad dissemination of critical ideas related to social justice in contexts (i.e., mathematics) that would not normally be considered as potential spaces for discussions of equity and justice.

We found that group members kept in touch after the symposium. For example, a calculus group concentrated on identifying environmental social justice issues and activities relevant to calculus courses. Although there were many ideas and topic suggestions for teaching modules, we quickly realized that the public data sources limited participants' choices. The group decided to concentrate on the Flint Water Crisis, as it was frequently mentioned in the press at the time. After the workshop, the group kept in touch via e-mail and exchanged ideas and resources on the Flint Water Crisis. This speaks to the first goal identified in the grant project, as well as the broader goal of the *Diversity and Inclusion* grant goals.

The symposium's website (<https://socialjusticemathematics.weebly.com/>) also continues to serve as an open platform across participants and ACS campuses. The website contains material provided by our facilitators, and it will ultimately include the teaching modules produced by the participants. This will provide one of the sustainable impacts of the project.

5. **Lessons Learned**

Describe the surprises, challenges, and lessons learned during the project, e.g., is there something you are very glad you did or would do differently? Did you face obstacles that called for creative problem-solving? What would have made the project even more successful?

This symposium aimed to broaden approaches for teaching mathematics across ACS institutions and help mathematics courses attend to diverse experiences and become more inclusive, which was overall successful. However, we learned that supporting faculty in this area takes time and we may consider an additional afternoon of work or a follow-up video call between groups to help faculty feel more supported in their module development.

6. **Next Steps**

Explain what you intend to do with/how to you intend to use or build on the results of your project. You should also highlight any ongoing, post-grant initiatives that would indicate the "sustainability" of the project or its outcomes.

The primary takeaway from our survey data and faculty modules' review was that social justice mathematics has become a topic of great interest in undergraduate settings, and that more symposia and meetings focused on this topic will provide faculty with an opportunity to develop the tools and resources needed to impact their classrooms. Given that faculty have developed early ideas, we plan to invite participants to a formal research study this year.

7. **Feedback/suggestions for the ACS grant program (optional)**

We are grateful to the ACS for their support of our interests and collaboration. We have no specific feedback or suggestions at this time. Thank you.