Pre-service teachers’ emerging views on educational equity

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Pre-Service Teachers’ Emerging Views on Educational Equity

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Abstract

An equity-based Statistics course for pre-service mathematics teachers could play a role in the development of pre-service teachers’ equity literacy, encouraging conversations about equity in education and illuminating structural factors that contribute to the educational opportunity gap in the U.S. In the Winter 2019 semester, a faculty team at the author’s university piloted such a course. The course included data explorations dealing with structural inequities by race – one of the most difficult topics to address productively in a teacher preparation course.

For the present study, a survey of pre-service teachers’ views on educational equity was administered in a required Social Foundations course for pre-service teachers as well as in the Statistics for Teachers pilot section. Pre-post analysis of this survey, along with interviews and classroom observations in both courses, illuminated the ways in which each course contributed to pre-service teachers’ emerging views on educational equity. In this paper the results of the study are analyzed in the context of the history and sociology of American education as well as the existing literature on equitable teaching practices and teacher education.
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Pre-Service Teachers’ Emerging Views on Educational Equity

Introduction

Concerns about equity in education have formed a significant part of our national consciousness in recent years. The media have alerted Americans to the deplorable condition of public school buildings (AFTHQ, 2016) and the “achievement gap” between high- and low-income children (“Achievement gaps: The system’s biggest challenge,” n.d.). Scholars have also raised concerns about K-12 curricula that assume White, middle-class cultural norms and a Eurocentric point of view when so many of our public school children are excluded by these assumptions (Delpit, 2013; Henry, 1994; New York State Special Task Force on Equity and Excellence in Education, 1989).

The federal government’s response to the “achievement gap” has been, among other things, to institute performance-based pay systems which measure how successful a teacher is in closing gaps between demographic groups on standardized tests (115th Congress, 2018). But while most U.S. states now include some diversity requirements within their teacher certification frameworks, these are insufficient to prepare teachers to provide a high-quality, equitable education for students from demographic groups different from their own (King & Butler, 2015). This is no small concern, since teachers are predominantly White and have upper middle-class family incomes, while children in the United States are much more diverse by race, ethnicity, and family income (see Figures 1 and 2).
King and Butler (2015) argue that every required course in an undergraduate teacher preparation program should have a component related to diversity, teacher identity, and/or the social/political context of education; in most of the institutions they studied, however, fewer than 20% of the required courses had a component like this. Given these concerns, new curriculum materials for
teachers should attend to equity and social justice in education, not only in the required Social Foundations course(s) but in subject area courses as well. Statistics content forms a significant part of the Common Core State Standards for Mathematics (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010); one current teacher education initiative is to develop free online curriculum materials for a Statistics for Secondary Teachers course (Mathematics Teacher Education Partnership, n.d.). This study explores the incorporation of equity-related topics in a new Statistics course for pre-service secondary mathematics teachers. The research questions are: How do pre-service teachers initially conceptualize educational equity when they enter a teacher preparation program? Where do they place the responsibility for a child’s educational success: on individual, cultural, or structural factors? How can these perspectives shift, especially in the areas of racial equity and social justice, through exploring equity-related data in a course on Statistics for Teachers?

The genesis of the present study stemmed, in part, from the researcher’s involvement in the writing team for the Statistics for Secondary Teachers course, through the university’s Mathematics and Statistics department, while working toward a Social Foundations master’s degree in the College of Education. Because of my involvement in both departments, I was asked to draw on the equity literacy theory, activities, and pedagogy already taking place in the Teacher Education department in order to inform our writing and evaluation of the Statistics for Secondary Teachers course materials. Specifically, the writing team wanted to learn about the goals and outcomes of the Social Foundations course that is required for all undergraduate pre-service teachers, Schools for a Diverse and Democratic Society. Using mixed methods, the goals and outcomes of one section of the Social Foundations course were explored; at the same time,
nearly identical methods and measures were used in a pilot section of the *Statistics for Secondary Teachers* course.

The writing team for the *Statistics for Secondary Teachers* course had several equity-related goals in mind. First, we wished to create a classroom environment where emotional topics like race could be discussed in an honest and productive way (Case & Hemmings, 2005; Tatum, 1992). Second, we wanted pre-service teachers to investigate data related to the structural inequities that exist in our current educational system and in our broader culture. Robinson (2007) found that teachers who believe poverty is rooted in social structure, rather than just individual choices, are more apt to be present in and to persist at poor schools. Data used in a Statistics course has the potential to reveal some of these structural inequities: for example, data on school funding per pupil in Pennsylvania shows race-related disparities, even after accounting for each district’s median income level (McCorry, 2016). Our third equity-related goal was to help pre-service teachers identify biases in how they perceived families of color and families experiencing poverty. Biases of this kind can lead to low expectations of students from these families, which in turn lead to low-quality instruction (Association of Mathematics Teacher Educators, 2017). Recent research suggests that teacher expectations affect students’ long-term educational attainment, including college completion (Papageorge, Gershenson, & Kang, 2018).

Mathematics education researchers have developed the idea of teaching mathematics for social justice (TMfSJ) – a form of critical pedagogy where teachers use the tools of the classical discipline to give students agency in identifying and disrupting structural inequities (Gutstein, 2007). This kind of critical pedagogy draws on and strengthens all three of our equity-related goals. Our materials extend the principles of TMfSJ to the discipline of Statistics, where there is ample scope for critical pedagogy. We feature a community-based effort in Oakland, CA, where
students joined with adults in counting the number of diesel-fueled trucks that regularly drove through their low-income Black neighborhood. Based on the data they collected, they succeeded in changing a city ordinance so that these trucks had to be re-routed (Episode three: Counting trucks, 2017). In the MODULE(S²) Statistics for Secondary Teachers materials (Mathematics Teacher Education Partnership, n.d.), the authors give this example of critical statistics pedagogy and then ask pre-service teachers to imagine a unit plan structured around this problem. We also guide them in planning a Statistics lesson that could follow up on a student-led protest of Detroit school closings (Knoxx, 2012).

The MODULE(S²) Statistics for Secondary Teachers course (Mathematics Teacher Education Partnership, n.d.) is among the first of its kind – perhaps (based on an extensive literature search) the very first curriculum that combines Statistics content and secondary pedagogy with an explicit focus on equity and social justice. The course materials are in the piloting stage. The results of this study have allowed the researcher to make recommendations to the course developers on how to optimize the most promising features of the materials and add content that fills in remaining equity-related knowledge gaps.

**Literature Review**

**Equity in Education**

As we attempt to conceptualize educational equity, we should note that there are many definitions stemming from different social and political philosophies. Much of current educational policy in the U.S. is rooted in utilitarian social philosophies (Noddings, 2015). But the utilitarian principle of the greatest good for the greatest number is an insufficient basis for educational equity. Dewey argued that “what the best and wisest parent wants for his own child, that must the community want for all its children. Any other ideal for our schools is narrow and
unlovely; acted upon, it destroys our democracy” (emphasis added; as cited in Noddings, 2015, pp. 176-177). This personalizing of the goal of educational policy is related to the ethic of care advocated by some feminist scholars: being moved to decision and action through a genuine encounter with a real person who is suffering (Noddings, 2015).

Different conceptions of educational equity have been expressed through various movements in U.S. history. Makar (2004) categorizes these multiple conceptions under three broad banners: equality of input, equality of outcome, and fairness. As an illustration of how these ideals can interact and clash, consider the current debate on equity in secondary mathematics education. The National Council of Teachers of Mathematics (NCTM, 2014a) has published the following position statement:

When access and equity have been successfully addressed, student outcomes—including achievement on a range of mathematics assessments, disposition toward mathematics, and persistence in the mathematics pipeline—transcend, and cannot be predicted by students’ racial, ethnic, linguistic, gender, and socioeconomic backgrounds. (n.p.)

This is primarily an “equality of outcomes” conception of equity. However, the NCTM (2014c) also elaborates that “equitable teaching practice involves noticing students, learning about the worlds they live in, and building mathematics that comes from these worlds” (p. 1). Connecting mathematics instruction to students’ experiences has been considered a best practice at least as far back as Jean Lave’s (1988) studies on situated cognition. Proponents of culturally relevant pedagogy have pointed out that curricular connections to students’ everyday lives are typically organized according to White, middle-class cultural practices (Rubel, 2017); this, then, does not stand up under the fairness conception of equity.
Danny Martin (2015), a Black mathematics education scholar, has pushed the NCTM to go even further by considering the kind of liberating education that is needed by the Black community. For Martin, the NCTM’s conception of equity is “rooted in an implicit benevolent appeal and the provision of accommodations that will allow African American, Latin@, Indigenous, and poor students to enjoy contingent benefits of the system that is not set up for them or by them” (p. 22). Requests for benevolence of this kind would have no place in a decolonizing form of mathematics education; rather, the development of critical mathematical literacy would allow marginalized students to understand and change an educational system that is continuing to oppress them.

By any of these standards, equity in education has not been achieved in the U.S. Witness the racial inequality of outcomes on test scores (National Center for Education Statistics, n.d.-a), graduation rates (National Center for Education Statistics, n.d.-b), and social class mobility (Badger, Miller, Pearce, & Quealy, 2018a). Gross inequality of input, too, is clearly illustrated in many current media accounts (Glass, 2015a, 2015b) and documented in statistical studies (for example, Tilsley et al., 2017).

**Deficit views of students and communities.** Surprisingly, some still argue that equality of input has been achieved or, at least, the “achievement gap” is due to deficits in the students or communities who are not experiencing success. Furthermore, equality of input may not even be a desirable goal, by the utilitarian logic that it would be a waste to give children a building they “wouldn’t appreciate” or a rigorous curriculum that would not be likely to generate much human capital for our nation (Lipman, 2011; Noddings, 2015).

In the Unites States, there is a long history of locating educational problems in the “deficient” cultures, languages, and family structures of immigrants, the working class, and
people of color (Pimpare, 2008). Examples include the Americanization movement in the early 20th century, culture of poverty theories in the early ’60s, compensatory education in the 1960s and 1970s, and the Coleman Report in 1966, which found that differences in student background and socioeconomic status have a greater effect on educational outcomes than school resources and curriculum (Lipman, 2011, p. 91). Currently, race may not be mentioned but culture is a proxy in a discourse about certain essentialized negative traits, such as a lack of effort, inappropriate values, or problematic behaviors and that prevent people from succeeding.

**Individual vs. structural views.** Gorski (2016) describes a range of explanations for unequal educational outcomes. On one end of the continuum are people, including educators and policy-makers, who see people experiencing poverty as the agents of their own economic conditions – a common view among people who have not experienced poverty. For example, low rates of in-school family involvement among parents experiencing poverty or higher relative rates of school absences among students experiencing poverty is interpreted, in their view, as evidence that people experiencing poverty do not value their children’s education (Gorski, 2016, p. 381). On the other end of the continuum are people who tend to understand poverty and issues such as family involvement disparity as the logical, if unjust, outcomes of economic injustices, exploitation, and inequity (Gorski, 2016, p. 380).

Lipman (2011) further specifies some of the underlying structural and ideological roots of the disparities in urban public schools: “grossly inequitable allocation of resources, Eurocentric and racist curricula, racial segregation, criminalization, lack of space for genuine participation of communities most affected, and cultural marginalization and psychic assault on working class students of color” (Lipman, 2011, p. 47). In a similar vein, Milner (2012) has proposed several major factors that help explain the so-called “achievement gap” for students of color in the U.S.:
color blindness, cultural conflicts, meritocratic beliefs regarding education, deficit mindsets, and low expectations of students of color on the part of teachers and educational leaders.

**Educational Equity and Teacher Preparation**

In an educational foundations course for pre-service teachers, Mueller and O-Connor (2007) found that pre-service teachers were initially unable to situate their own educational trajectories in a broader social context characterized by structured privilege and disadvantage. Instead, they credited their educational outcomes to individual attributes such as ability, personal effort, and the value their parents placed on education (pp. 844-845). Annette Lareau (1987) has detailed the ways in which middle-class expectations of parents and families contribute to the mistaken view that working-class families do not value education. Gorski (2016) contends that contemporary college students have been socialized to believe that the U.S. educational system is a meritocracy, with deficit views of children and families in poverty as a necessary corollary. These beliefs significantly hinder a teacher’s effectiveness at equitable teaching:

> If a teacher believes people experiencing poverty are inherently deficient, no amount of instructional strategies will adequately prepare that teacher to see and respond to the conditions that actually underlie educational outcome disparities. Furthermore, how can a teacher believe that a student’s mindset is deficient, that she is lazy, unmotivated, and disinterested in schools and also build a positive, high-expectations relationship with her? (Gorski, 2016, p. 382)

Thus, pre-service teachers’ deficit views of children and families in poverty, as well as families of color, are an important area of focus in this study.

**Teacher preparation in mathematics and statistics.** Equity in education is of growing concern in the mathematics and statistics education community. The National Council of
Teachers of Mathematics’ *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014b) states that “an excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential” (p. 59). Yet White, middle-class mathematics teachers struggle to engage in the kind of culturally relevant pedagogy that might begin to close the opportunity gap in mathematics education (Rubel, 2017). In addition, Tatum’s (1992) observations about her students in a course on the psychology of racism may be particularly applicable to mathematics teachers:

One common response to the discomfort [of understanding racism as a system of advantage] is to engage in denial of what they are learning. White students in particular may question the accuracy or currency of statistical information regarding the prevalence of discrimination (housing, employment, access to health care, and so on). More qualitative data, such as autobiographical accounts of experiences with racism, may be challenged on the basis of subjectivity. (p. 6)

This underlines the need for equity-related data in content area courses, such as Statistics, for pre-service mathematics teachers.

**Equity-related content in the MODULE(S²) Statistics for Teachers course.** In her framework for equity-directed mathematics teaching, Rubel (2017) identifies culturally relevant pedagogy (CRP) and teaching math for social justice (TMfSJ) as two separate practices, both of which are difficult for White teachers. But the classroom (and out-of-classroom) practice of generating real statistical data may prove to be an effective way of uniting the two: teachers are forced to enter the spaces of students’ out-of-school lives in order to identify issues that would be an appropriate focus for a critical statistics unit. Not only this, but it addresses Gorski’s (2016)
concern that out-of-school inequities appear to most current and future educators far outside their spheres of influence. While he suggests that there are things teachers can do within their classrooms and schools to mitigate injustice, his recommendations stop short of engaging in activism through academic disciplines. The authors of the MODULE(S^2) *Statistics for Secondary Teachers* course (Mathematics Teacher Education Partnership, n.d.) believe that understanding critical statistics pedagogy will empower teachers even as they empower their future students.

While infusing social justice content into a content area course is challenging, there are some ways in which the goals for a statistics course dovetail with the social justice goals outlined above. For example, best practices for teaching Statistics have been outlined in the *Guidelines for Assessment and Instruction in Statistics Education (GAISE)* report (Franklin, 2007). One such guideline is the use of real data:

> It is important to note that the examples selected for illustrating key concepts and the problem-solving process of statistical reasoning are based on real data and real-world contexts. *Those of you reading this document are stakeholders, and will need to be flexible in adapting these examples to fit your instructional circumstances.* (p. 21)

In accordance with this, we have collected real data related to equity in education. The MODULE(S^2) *Statistics for Secondary Teachers* course allows pre-service teachers to explore this data themselves and generate their own conclusions. This is synergistic with Tatum’s (1992) recommendation for helping college students come to terms with the reality of racism as a system of advantage:

> The creation of opportunities for self-generated knowledge on the part of students is a powerful tool for reducing the initial stage of denial that many students experience. While it may seem easy for some students to challenge the validity of what they read or what
the instructor says, it is harder to deny what they have seen with their own eyes. (p. 18)

Another important part of the work of learning, especially when that learning involves a significant shift in perspective, is engaging in critical self-reflection. For Tatum (1992), “[one] way all students can be empowered is by offering them the opportunity to consciously observe their own development” (p. 21). This, too, has the potential to be synergistic with best practices in statistics education. In a college statistics course, making students part of the data set has been shown to improve students’ satisfaction and interest in the course material by engaging them as research participants (Brown, 2016, 2017). With this in view, we have leveraged the Statistics for Secondary Teachers course to help pre-service teachers reflect on their understanding of educational equity by having them analyze some of their own data from a survey about equity, taken near the beginning of the course.

Surveying pre-service teachers regarding their views on educational opportunity and the “achievement gap” in the U.S. is not a new idea. It has been used in educational foundations courses (see, for example, Mueller & O’Connor, 2007) as a way of helping pre-service teachers reflect on equity and articulate their own views. In addition to this, the Statistics for Teachers course uses the survey as a tool for meta-dialogue before beginning a discussion in which students may be reluctant to participate (Case & Hemmings, 2005), creating a classroom environment where emotional topics like race can be discussed in an honest and productive way. Furthermore, Makar (2004) has found that providing some historical context for educational equity debates can break down barriers to discussing some of the more emotionally and politically charged topics in education today. Our survey introduces some of this context by asking pre-service teachers to identify with definitions of equity espoused by historical movements in U.S. history.
Gorski’s (2018) framework for equity literacy outlines the skills and dispositions that teachers need in order to create equitable learning environments and to teach youth about equity. This equity literacy framework is reproduced below; the specific skills and dispositions that we address through the *Statistics for Secondary Teachers* course are marked with an asterisk.

Figure 3: Equity Literacy Abilities (Gorski, 2013, pp. 22-23)

<table>
<thead>
<tr>
<th>Equity Literacy Abilities</th>
<th>Examples of Associated Skills and Dispositions</th>
</tr>
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</table>
| Ability to *Recognize* biases and inequalities, including those that are subtle. | Equity-literate educators:  
  - Notice even subtle bias in classroom materials, classroom interactions, and school policies*;  
  - Know and teach about how notable people in their content disciplines have used their knowledge to advocate for just or unjust actions of policies*; and  
  - Reject deficit views that locate the sources of outcome inequalities (like test score disparities) as existing within the cultures of, rather than pressing upon, low-income families*. |
| Ability to *Respond to* biases and inequities in the immediate term. | Equity-literate educators:  
  - Have the facilitation skills and content knowledge necessary to intervene effectively when biases or inequities, such as gender bias or sexism, arise in the classroom or school;  
  - Cultivate in students the ability to analyze bias in classroom materials, classroom interactions, and school policies*; and  
  - Foster conversations with colleagues about bias and equity concerns in their schools*. |
| Ability to *Redress* biases and inequities in the long term. | Equity-literate educators:  
  - Advocate against inequitable school practices, such as racially or economically based tracking, and advocate for equitable school practices*;  
  - Never confuse celebrating diversity with equity, such as by responding to racial conflict with cultural celebrations; and  
  - Teach, in relevant and age-appropriate ways, about issues like sexism, poverty, and homophobia. |
Ability to *Create and Sustain* a bias-free and equitable learning environment.

<table>
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<th>Equity-literate educators:</th>
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<td>• Express high expectations for all students through higher-order pedagogies and curricula*;</td>
</tr>
<tr>
<td>• Consider how they assign homework and communicate with families, understanding that students have different levels of access to resources like computers and the Internet; and</td>
</tr>
<tr>
<td>• Cultivate a classroom environment in which students feel free to express themselves openly and honestly*.</td>
</tr>
</tbody>
</table>

As teacher educators we, too, wish to engage in the kind of self-reflection recommended by Gorski (2016): for example, are we providing pre-service teachers with adequate structural context so that they will be able to identify and respond to the core causes of educational disparities? In this instance, we have used the pre-post survey as a tool for gauging how effective we have been in helping teachers reach our equity-related goals.

**Researcher Positionality**

I am a White, middle-aged woman with some experience as a high school teacher. Having grown up in an urban neighborhood and attended a predominantly African American elementary school, I have a particular and personal interest in the concerns of the African American community. Throughout my adult life, I have enjoyed interacting with adolescents, including my own teenaged children. During the bulk of my teaching experience, I had not yet developed my own views on educational equity, but I was in some school situations where I felt that the students were being treated very badly. This has made me a passionate defender of high school students, vigilant in spotting a lack of respect for them or their families.

It was therefore with some apprehension that I embarked on a study with undergraduate pre-service teachers as the participants, since I wondered whether I would be able to connect empathetically with them. However, I found myself able to develop warm relationships with the pre-service teachers in this study, while also noting the misconceptions some of them still hold
about people in poverty and people of color. I feel that I have been changed through this research project. Before the study, I had a structural view of the barriers faced by marginalized groups of students, while still holding an individualistic view of teachers. In the course of the study I have maintained (and strengthened) my structural view of the barriers facing students. But I have also adopted a more structural view of teachers’ constraints, recognizing that one of the barriers they face in seeking to be good educators is the societal misinformation they may have unwittingly absorbed about people experiencing poverty and people of color.

**Methods**

Figure 4: Study Design Overview

An overview of the study design is illustrated above, in Figure 4. The study was conducted at a racially diverse but predominantly White Midwestern university, in two course sections: *Statistics for Secondary Teachers* (also referred to as *Statistics for Teachers*), taught by Professor Ellis, and *Schools for a Diverse and Democratic Society* (also referred to as *Social Foundations* or SFCE), taught by Professor Carter. Both course instructors are White males, and both names are pseudonyms. No student in either class was concurrently enrolled in the other
class; furthermore, there were no pre-service mathematics teachers in the Social Foundations group, while all of the students in Statistics for Teachers were secondary math majors or minors.

**Initial Survey.** At the beginning of the semester, pre-service teachers in Statistics for Teachers and Social Foundations were surveyed about their feelings and views about educational equity. The survey response rate was 88% in Social Foundations and 100% in Statistics for Teachers. A copy of the survey is included as Appendix A. Initial responses for both courses provided baseline measurements for (1) conceptions of educational equity, (2) attributions of responsibility for educational success, and (3) comfort or discomfort level with discussions about educational equity (including a specific question about discussing race).

Responses were analyzed in order to determine any associations between responses to different survey questions; likewise, any associations between responses and the demographics of the pre-service teachers. Demographic characteristics of the survey respondents are summarized below, in Table 1.

Table 1: Pre-semester Survey Respondent Demographics

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations n = 23</th>
<th>Statistics for Teachers n = 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has disability</td>
<td>3 (13%)</td>
<td>3 (23%)</td>
</tr>
<tr>
<td>English is first language</td>
<td>23 (100%)</td>
<td>13 (100%)</td>
</tr>
<tr>
<td>First generation college</td>
<td>7 (30%)</td>
<td>2 (15%)</td>
</tr>
<tr>
<td>Person of color</td>
<td>2 (9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Female</td>
<td>17 (74%)</td>
<td>7 (54%)</td>
</tr>
<tr>
<td>Non-gender binary</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Already taken SFCE</td>
<td>n/a</td>
<td>7 (54%)</td>
</tr>
<tr>
<td>Currently taking SFCE</td>
<td>23 (100%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

The surveys given in both classes were identical, except for one added question on the Statistics for Teachers survey about whether or not the respondent had already taken, or was currently taking, the Social Foundations course.

**Initial Interviews.** Volunteers were solicited to participate in short (10 - 20 minute)
follow-up interviews in order to gain further insight into the reasons for pre-service teachers’ initial answers to the survey questions. Participants were informed that none of their responses would affect their grade in the courses, but were offered a small amount of extra credit in return for interview participation.

Interviews were semi-structured, using questions tailored to the interviewee’s survey responses. A copy of each interviewee’s own survey responses was provided for reference. The basic interview protocol is shown in Figure 5, below. Demographics for both pre- and mid-semester interviewees are summarized in Table 3.

Figure 5: Pre-Semester Interview Protocol

<table>
<thead>
<tr>
<th>After survey 1, “Preparing to Discuss Equity Issues” (beginning of semester):</th>
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<tr>
<td>1. [If disagreed with statement “I am comfortable discussing educational equity issues involving race, gender, disability status, and poverty, in my college classes.”] Talk about what makes you uncomfortable discussing these topics.</td>
</tr>
<tr>
<td>2. [If agreed with statement “When discussing equity issues, I worry that I will say the wrong thing and offend someone.”] What is an example of something you might say that would offend someone?</td>
</tr>
<tr>
<td>3. [If agreed with statement “When I am asked to identify my race, socioeconomic status, gender, or disability status, the possibility of being &quot;put in a box&quot; bothers me.”] Can you say more about why this bothers you?</td>
</tr>
<tr>
<td>4. Can you say more about your [agree or disagree] response to “Some cultural or socioeconomic groups value education more highly than others”?</td>
</tr>
<tr>
<td>5. [If agreed with any statement about unfairness in educational system] What makes our current educational system unfair to these students?</td>
</tr>
<tr>
<td>6. [If agreed with “My opinions about race-related issues differ from those of my family and friends.”] In what ways are your opinions different? Do you feel this affects the way you relate to them? To instructors and peers in your college classes?</td>
</tr>
</tbody>
</table>

Change in survey question. As a result of the unique response of one interviewee, an important change had to be made to the survey before re-administering it at mid-semester. The prompt, “Some cultural or socioeconomic groups value education more highly than others” had
been intended to gauge whether respondents felt that people with low incomes and people of color valued education less than their White, affluent counterparts. However, one respondent who had agreed with that statement specified in his interview that he believed people with low incomes value education more than their more affluent counterparts. This revealed the invalidity of the prompt, since an “agree” response is ambiguous as to who values education more than others. It was decided to keep the original prompt, but also add an additional question at the end of the survey: “Generalizing from your knowledge and experience, how much do the following types of families value their children’s education?” Respondents were asked to use a three-point scale of “not very much,” “moderately,” and “highly,” to rate families in four racial/ethnic groups and five income brackets. Aside from that change, and the slightly different title and introductory sentence, the surveys given at pre-and mid-semester were identical.

**Classroom Observations.** My role as the researcher was that of a participant-observer in both classes, attending every class meeting and taking written field notes. The ways I participated in the classes were slightly different, due to the different room configurations and my different relationship to each instructor. In the *Social Foundations* class, I sat with the students in their small groups, since there was not a space for a more removed observer. I participated in friendly conversation, but did not contribute to the discussions dealing with course content, so that I would not unduly influence the students’ conversations. Students knew me as the instructor’s graduate student in *Social Foundations*. In the *Statistics for Teachers* class, I sat at my own desk at the back of the room. Students knew me as a member of the course writing team, doing graduate studies in the College of Education at the university. I shared that I had been in their shoes not so long ago, as a pre-service secondary mathematics teacher. On a few occasions I helped students who were struggling with technology during individual or group
work time; on one occasion I conducted a brief whole class discussion related to critical pedagogy.

**Follow-Up Survey.** The survey was re-administered at mid-semester, after pre-service teachers have been exposed to new information about educational equity. Participation at that time was 91% in *Statistics for Teachers* and 68% in *Social Foundations*. The plan was to pair survey responses for pre- and mid-semester by using an anonymous 4-digit code known only to the participant. The decision to persist in using paired responses in the data analysis was made after some consideration, however, because it entailed a reduction in sample size. Not only did some of the pre-service teachers drop the classes, but there were some who did not complete one or both rounds of the survey. Furthermore, 3 of the 17 mid-semester responses in *Social Foundations* could not be paired with their corresponding pre-semester responses because the 4-digit identification codes entered did not match. Thus, only 14 of the *Social Foundations* students had intact paired responses. Attrition was somewhat less severe in the *Statistics for Teachers* course: 10 of the original 13 survey takers completed the mid-semester survey, and all 10 were paired successfully with their pre-semester surveys.

Although every effort was made to remind students to complete the surveys, this attrition was an unavoidable consequence of the decision to make the surveys anonymous and therefore optional. The value of using paired responses outweighed these considerations, however, and the tools that were used to determine statistical significance\(^1\) are accurate for small sample sizes. Demographic characteristics of the paired survey respondents are summarized below, in Table 2.

---

1 Hypothesis tests were conducted using randomization methods: p values were computed using 5,000 bootstrapped simulations of the null hypothesis, with the true sample size.
Table 2: Paired Survey Respondent Demographics

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations n = 14</th>
<th>Statistics for Teachers n = 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has disability</td>
<td>1 (7%)</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>English is first language</td>
<td>14 (100%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>First generation college</td>
<td>4 (29%)</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Person of color</td>
<td>2 (14%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Female</td>
<td>10 (71%)</td>
<td>4 (40%)</td>
</tr>
<tr>
<td>Non gender binary</td>
<td>1 (7%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

**Follow-up interviews.** A second round of interviews was conducted at mid-semester. It was not required for mid-semester interviewees to have completed the pre-semester interview.

Interviewee demographics for both rounds of interviews are summarized below, in Table 3.

Table 3: Interviewee Demographics

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations n = 11</th>
<th>Statistics for Teachers n = 7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Mid</td>
</tr>
<tr>
<td>Total for each round</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Has disability</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>First generation college</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Person of color</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Non-gender binary</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Already taken SFCE</td>
<td>n/a</td>
<td>4</td>
</tr>
<tr>
<td>Interviewed twice</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

The main focus of the second round of interviews was the shifts in perspective that had resulted from participation in the two courses. Interviewees were also asked about their responses to the newly added prompt, “Generalizing from your knowledge and experience, how much do the following types of families value their children's education?” In addition, because the mid-semester surveys had shown a large change in opinions about fairness to female students in mathematics, interviewees were asked about the reasons for their responses to that prompt (time...
permitting). Like the pre-semester interviews, these interviews were semi-structured, according to the protocol shown in Figure 6.

Figure 6: Mid-Semester Interview Protocol

| After survey 2, “Discussing Equity Issues (Followup)” (mid-semester): |
|---|---|
| 1. [If disagreed with statement “I am comfortable discussing educational equity issues involving race, gender, disability status, and poverty, in my college classes.”] Talk about what [still] makes you uncomfortable discussing these topics. |
| 2. [For each question where the response changed] Your response to [statement] changed from _________ to ___________. What made you change your mind? |

Both instructors were interviewed at the end of the semester about their overall goals for the courses and their assessment of how well these goals had been met.

For the interviews and field notes, a full qualitative analysis (emergence and subsequent coding of themes) is beyond the scope of this paper. At this stage in the research project, qualitative results will be given only as illustrations and possible explanations for the quantitative results.

**Results**

Because the survey used Likert scales and ordinal variables, quantitative analysis is possible only if we permit categorical responses to be assigned numeric values. Statisticians differ on this practice: for some, quantitative analysis should only be done on truly quantitative variables such as temperature, time, and test scores (A. Ross, personal communication, May 16, 2019). The analysis here has been conducted with this in view, recognizing that assigning integer scores to degrees of agreement or disagreement is somewhat arbitrary. However, since this is an exploratory study, even a crude quantitative analysis is helpful in pointing the way toward the more refined research questions that will emerge from it.
Pre-Semester Responses

Discussing equity in college classes. The following survey prompts dealt with pre-service teachers’ feelings about discussing equity in college classes. Each was rated on a four-point Likert scale (when reporting binary responses, “strongly disagree” is combined with “disagree” and “strongly agree” is combined with “agree”).

- I am comfortable discussing educational equity issues involving race, gender, disability status, and poverty, in my college classes.
- When discussing equity issues, I worry that I will say the wrong thing and offend someone.
- When discussing equity issues, others are likely to do or say things that hurt or anger me.
- When I am asked to identify my race, socioeconomic status, gender, or disability status, the possibility of being "put in a box" bothers me.

An analysis of the initial survey showed that there were no significant differences on any question between the students in Social Foundations and Statistics for Teachers. Furthermore, even though about half of the Statistics for Teachers students had already taken the Social Foundations class, there were no significant differences between those who had and had not taken it. Therefore, all of the data from the two classes was combined for the initial analysis.

Several of these variables were linked with other respondent characteristics. These were tested for statistical significance using a hypothesis test for a difference of proportions.
Table 4: Incoming Responses on Discussing Equity Issues (classes combined)

<table>
<thead>
<tr>
<th>Significant connections with other variables</th>
<th>% Agree (binary response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfortable Discussing</td>
<td>89%</td>
</tr>
<tr>
<td>All 4 PSTs who disagreed with this statement agreed that “My opinions about race-related issues differ from those of my family and friends” (p &lt; 0.05).</td>
<td></td>
</tr>
<tr>
<td>Worry (others)</td>
<td>72%</td>
</tr>
<tr>
<td>Of the 9 PSTs who disagreed with this statement, 8 also disagreed with “When interacting with others, I think about their race” (p &lt; 0.1).</td>
<td></td>
</tr>
<tr>
<td>Might Anger Me</td>
<td>17%</td>
</tr>
<tr>
<td>All 6 PSTs who agreed with this statement also agreed that “My opinions about race-related issues differ from those of my family and friends” (p &lt; 0.01).</td>
<td></td>
</tr>
<tr>
<td>Put in Box (self)</td>
<td>25%</td>
</tr>
<tr>
<td>45% of male respondents agreed with this statement, while only 16% of non-male respondents agreed (p &lt; 0.05).</td>
<td></td>
</tr>
</tbody>
</table>

Agreement with the statement that “My opinions about race-related issues differ from those of my family and friends” was associated with two other responses. The first was being uncomfortable discussing educational equity issues in class. This aligns with Case and Hemmings’ (2005) finding that some of the White pre-service teachers they studied had already
had stormy conversations with relatives, where they had felt silenced when taking an antiracist stance. This contributed to their reticence in class, because the taboo on race-related topics had been painfully reinforced for them through these negative experiences. The follow-up interviews in this study showed that such conversations had taken place in the families of many pre-service teachers in both classes.

The second response that was associated with agreement that “My opinions about race-related issues differ from those of my family and friends” was agreement that “When discussing equity issues, others are likely to do or say things that hurt or anger me.” This may be a confirmation of Tatum’s (1992) observation that White students sometimes express a sense of betrayal when they realize the gaps in their own education about racism. In this study, one White respondent who agreed with both of these survey prompts wrote in that “if an individual uses slurs directed towards a specific group of people, I will then take it personally and be offended.”

The majority of the pre-service teachers (75%) agreed that “When discussing equity issues, I worry that I will say the wrong thing and offend someone.” But, of the 25% who disagreed with this, almost all also disagreed that “When interacting with others, I think about their race.” This may point to an over-confidence in the “correctness” of a colorblind stance toward others.

Finally, there was an interesting association found for the response to, “When I am asked to identify my race, socioeconomic status, gender, or disability status, the possibility of being “put in a box” bothers me.” Unfortunately, the sample size of students of color was too small for an analysis of association with race. Furthermore, very few students identified as being economically disadvantaged. Even when using first generation college status as a proxy for this, however, there was no association with feeling “put in a box.” There was an adequate balance of
genders and disability status for analyzing responses to this prompt. In the final analysis, the only trait associated with feeling “put in a box” was being male. Cameron explained this in his interview:

Cameron: I have my own beliefs and values but … am I always willing to put them out there? Not really, because people have this assumption about me and if I do share my belief they don't know by background. They don't know how I've carried that belief to this moment today. They don't how I've formed that belief…. I remember one time I voted for [candidate] and these girls were like, ‘you voted for [candidate], that means you hate women.’ …

Interviewer: What would you like them to have said?

Cameron: I would have liked them to ask more questions.

Since White males have been the dominant group in so many of our country’s power imbalances, it may be tempting to brush off the experience of being a male pre-service teacher as unimportant to an understanding of what it means to be minoritized. But, for Tatum (1997), “It is … helpful to consider the commonality found in the experience of being dominant or subordinate even when the sources of dominance or subordination are different” (p. 23). If men do feel temporarily silenced in certain educational settings, this might be leveraged as a learning tool. Cameron’s clearly stated desire for others to ask more questions of him, showing true and open curiosity about his experiences, echoes John Dewey’s (1927) statement about democratic dialogue:

The highest and most difficult kind of inquiry and a subtle, delicate, vivid and responsive art of communication must take possession of the physical machinery of transmission and circulation and breathe life into it. … [Democracy] will have its consummation when free
social inquiry is indissolubly wedded to the art of full and moving communication. (pp. 204-205; see also Parker, 2010)

**Feelings about race.** Incoming responses to the prompts related to race were also analyzed for connections with other variables. The three relevant prompts were:

- My race is an important part of my identity.
- When interacting with others, I think about their race.
- My opinions about race-related issues differ from those of my family and friends.

<table>
<thead>
<tr>
<th>Table 5: Incoming Responses on Feelings about Race (classes combined)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% Agree (binary)</strong></td>
</tr>
<tr>
<td>Race ID (self)</td>
</tr>
<tr>
<td>Think about Race (others)</td>
</tr>
<tr>
<td>Different Fam/Friends</td>
</tr>
</tbody>
</table>

There was a strong association between participants’ own sense of racial identity and their tendency to think about the race of others. This aligns well with Tatum’s (1992) theory of racial identity development. Nevertheless, it is a curious fact that even among those who agreed that “My race is an important part of my identity,” there were still many (43% within that group) who denied thinking about the race of others. This might simply indicate a lack of reflectiveness.
about race-related issues, but there is also the possibility that it reflects the taboos that continue to exist around issues of race among White pre-service teachers (Case & Hemmings, 2005) and the ways in which colorblind ideologies permeate the mainstream culture (Grossman & Charmaraman, 2009).

**Unfairness to specific groups of students.** The prompts related to unfair treatment of specific groups are listed below:

- Our current educational system is unfair to students with disabilities.
- Our current educational system is unfair to economically disadvantaged students.
- Our current educational system is unfair to students learning English as a second language.
- Our current system is unfair to students in racially segregated school districts.
- In racially integrated schools, our current educational system is unfair to minority students.
- Our current educational system is unfair to female students in mathematics.

The results of the pre-semester survey are summarized in Table 6. No statistically significant differences were found between the incoming Social Foundations and Statistics for Teachers classes.

Table 6: Unfairness of Current Educational System (incoming responses, binary)

<table>
<thead>
<tr>
<th>Incoming “Agree” responses</th>
<th>Social Foundations n=23</th>
<th>Statistics for Teachers n=13</th>
</tr>
</thead>
<tbody>
<tr>
<td>To students with disabilities</td>
<td>74%</td>
<td>69%</td>
</tr>
<tr>
<td>To economically disadvantaged stds.</td>
<td>91%</td>
<td>92%</td>
</tr>
<tr>
<td>To English language learners</td>
<td>91%</td>
<td>100%</td>
</tr>
<tr>
<td>To stds. in segregated schools</td>
<td>91%</td>
<td>85%</td>
</tr>
<tr>
<td>To minority stds. in integrated schools</td>
<td>78%</td>
<td>85%</td>
</tr>
<tr>
<td>To females in mathematics</td>
<td>26%</td>
<td>46%</td>
</tr>
</tbody>
</table>

No statistically significant differences were found between incoming classes.
Gender equity in mathematics education: connected variables. An interesting question is whether survey prompts about unfairness to various groups of students are answered in ways that reflect the respondent’s membership in those groups. For example, are students with disabilities more likely than others to believe that our education system is unfair to students with disabilities?

The responses to the following three prompts were analyzed for possible connections along these lines:

- Our current educational system is unfair to students with disabilities.
- Our current educational system is unfair to economically disadvantaged students.
- Our current educational system is unfair to female students in mathematics.\(^2\)

Since so few students self-identified as economically disadvantaged\(^3\), being a first-generation college student was used as a proxy for this category. Both classes were combined for this analysis because there was no significant difference found between the classes on these responses.

The results of the analysis showed that only one prompt had responses that were connected to the respondents’ group identification: “Our current educational system is unfair to female students in mathematics.” Agreement with that statement was significantly higher among female than non-female students (p < 0.1); furthermore, agreement with the statement was lower among first-generation college students than among those outside that group (p < 0.1). The latter result will not be discussed further here, except to postulate that information about the

\(^2\) The other three “unfairness” prompts could not be analyzed in this way, because of the extremely small number of pre-service teachers who do not identify as White, and the absence of any pre-service teacher who spoke English as a second language.

\(^3\) Professor Carter commented that, although this university has a large working-class population, in his experience very few of the working-class students identify as economically disadvantaged.
experiences of female students in college mathematics courses was less available to the first-generation students than to others at the beginning of the semester.

Table 7: Incoming Responses on Gender Inequity in Mathematics (classes combined)

<table>
<thead>
<tr>
<th></th>
<th>% Agree (binary)</th>
<th></th>
<th>% Agree (binary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>42%</td>
<td>First generation</td>
<td>11%</td>
</tr>
<tr>
<td>Non-female</td>
<td>17%</td>
<td>Non-first generation</td>
<td>41%</td>
</tr>
</tbody>
</table>

The female vs. non-female difference is interesting because it indicates that many people who are not female may feel the problem of gender inequity in mathematics education has been taken care of. Outreach initiatives like “Educate to Innovate” program have been calling so loudly for diversity in STEM fields, and investing so much money towards that outcome, that it seems almost ungrateful to insist that this has not actually resulted in equity (“President Obama kicks off ‘educate to innovate,’” 2009). Indeed, some claim that the large gender discrepancy in attrition in college STEM fields can actually be explained away by other variables (Chen, 2013). But, as we will explore in the Discussion section, equity may be defined very differently by people inside and outside of the marginalized group – and those inside may be most qualified to say whether it has or has not been achieved.

Mid-Semester Responses

All pre-post analyses presented here are paired. For the item, “Our current educational system is unfair to female students in mathematics,” whole-group as well as paired data were analyzed because of the interesting gender gap that had appeared in the whole-group analysis of the pre-semester survey.

Discussing equity in college classes. Pre-post analysis of the prompts related to discussing equity in college classes showed changes on the following items:
When discussing equity issues, I worry that I will say the wrong thing and offend someone.

When discussing equity issues, others are likely to do or say things that hurt or anger me.

Agreement with both of these statements decreased significantly in the *Statistics for Teachers* class but not in the *Social Foundations* class.

Table 8: Feelings about Equity-Related Discussions (Pre-Post)

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations n=14</th>
<th></th>
<th>Statistics for Teachers n=10</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group Average (Pre)</td>
<td>Group Average (Post)</td>
<td>Avg. Paired Difference</td>
<td>Group Average (Pre)</td>
</tr>
<tr>
<td>Comfortable Discussing</td>
<td>3.43</td>
<td>3.36</td>
<td>-0.07</td>
<td>3.40</td>
</tr>
<tr>
<td>Worry (others)</td>
<td>2.93</td>
<td>2.86</td>
<td>-0.07</td>
<td>3.00</td>
</tr>
<tr>
<td>Might Anger Me</td>
<td>1.64</td>
<td>1.50</td>
<td>-0.14</td>
<td>2.00</td>
</tr>
<tr>
<td>Put in Box (self)</td>
<td>1.64</td>
<td>1.64</td>
<td>0.00</td>
<td>2.30</td>
</tr>
</tbody>
</table>

*p < 0.1; **p < 0.05; ***p < 0.01, based on one-tailed hypothesis test (Likert scores, 1 through 4; 2.5 is neutral)

“Group Average” is for pre-post matched completers only

There are many possible reasons for this result, only a few of which will be examined here.

Certain overall differences between the courses may be relevant. First, the *Statistics for Teachers* class had multiple foci in addition to equity in education (i.e. technical statistics content and pedagogical content related to adolescents’ learning trajectories). Thus, less time was spent on content directly related to equity, while more time was spent on other difficult concepts which may have eclipsed the difficulty of discussing equity issues. Second, the *Social Foundations* class was larger, with 23 students at mid-semester, while the *Statistics for Teachers* section had
only 11 students at that point; this may have had an effect on the students’ comfort level when participating in whole-class discussions.

Third, in the *Statistics for Teachers* class all of the students identified as White, while in the *Social Foundations* class there were three students of color: two African American women and one woman who identified as racially mixed, both Black and White. Professor Carter, the *Social Foundations* instructor, stated in his interview that “the section you’re observing is probably the most diverse section you’re going to see in any course in this College [of Education] at that level.”

When asked whether he thought that this racial diversity might cause students to hold back during class discussions, Professor Carter answered that “generally speaking, my students of color tend to self-report to me that they feel like they can talk.” However, Professor Carter had observed that White students in diverse settings sometimes do not feel this way:

Sometimes White students say it, they're afraid of speaking because it’s … such a powerful discourse in our society that … you shouldn't speak if you're not sure you're going to say the “right” thing. And that's where, all of a sudden, a number of things get kind of alluded around. You know, in terms of bastardized notions of political correctness to, you know, other people “seeing” that they're being silenced … which acts as an, in my opinion, … an ideological subterfuge that provides an excuse for not engaging with the issue.”

The pre-semester survey responses in both classes, as well as the follow-up interviews, indicated nearly universal anxiety about saying the wrong thing. One *Social Foundations* student wrote on the survey, “I always worry about offending others because I don’t know the right terms to use when discusses [sic] things like culture, gender, and sexuality. Maybe we could discuss what
everyone is comfortable calling different groups?” Similarly, in the Statistics for Teachers class, write-in responses included, “Help me understand certain topics, if I say something wrong help me in the right direction so I know how to say in a later conversation,” and, “allow me to answer when I feel that it is appropriate for me to do so, I feel that in somewhat tense discussions like these I do better when I have a well thought response rather than one I force because I must say something.” These things were written by students in the all-White environment as well as in the racially diverse environment. Since both classes had a similar level of anxiety at the beginning of the semester, the subsequent difference in levels of anxiety about equity-related conversations may not be fully explained by the presence or absence of students of color in the classroom. Certain factors inherent in the Statistics for Teachers subject material itself, along with the instructor’s pedagogical decisions, may also have played a role in assuaging the pre-service teachers’ anxiety.

For example, in the class period following the first survey, Professor Ellis displayed bar charts summarizing the class’ responses to the prompts, “When discussing equity issues, I worry that I will say the wrong thing and offend someone,” and, “When discussing equity issues, others are likely to do or say things that hurt or anger me.”
If you agreed with the above statement, please describe any specific words or behaviors that you would like others in this class to avoid.

Using the "R" word
I have been called "mean" because of my opinions before. Some people think I am judgmental and critical of students of lower levels of success.
I do not expect to be offended in any way from a class discussion regarding this issue, however if an individual uses slurs directed towards a specific group of people, I will then take it personally and be offended.

List anything that the instructor or your fellow students can do to support your engagement with these conversations.

Help me understand certain topics, if I say something wrong help me in the right direction so I know how to say in a later conversation
Make it a conversation where everyone is/feels comfortable participating
I would like all to be respectful of all and politically correct.
allow me to answer when I feel that it is appropriate for me to do so, I feel that in somewhat tense discussions like these I do better when I have a well thought response rather than one I force because I must say something.
Professor Ellis pointed out that students were much more worried about offending someone else than about being offended themselves. He also displayed the entire list of responses to the write-in prompts, “If you agreed with the above statement, please describe any specific words or behaviors that you would like others in this class to avoid,” and, “List anything that the instructor or your fellow students can do to support your engagement with these conversations.” It may have reassured students to know what would be offensive to other students.

Professor Ellis made a pedagogical decision, early on in the course, to regularly “cold call” students to share their thinking at various stages of their statistical problem-solving process. Because of the small class size, this allowed him to hear from almost every student during every class period. While cold calling felt like a risky move that might intimidate students, observation of the class indicated that it seemed to induce more voluntary participation in whole-class discussions. Because all of the students were struggling to develop their statistical vocabulary and problem-solving skills, making mistakes in front of the class became less frightening. There was a solidarity in not knowing Statistics content that may have seeped into the larger class dynamic, giving students permission to not know all of the correct vocabulary or answers in equity-related conversations.

Finally, the nature of the Statistics course content required students to regularly write and pronounce taboo words such as “White,” “Black,” and “African American.” This may have allowed students to experience the absence of dire consequences when using these terms, alleviating some of the anxiety around race-related conversations. It may seem implausible that students would have entered the semester with such rigid taboos, but consider the following remarks made by Mackenzie, a pre-service teacher in the Social Foundations class who identified as racially mixed, both Black and White:
Mackenzie: Even in other classes like I took a multicultural children's book class and I would say something about Black character in a book and they’d be like, ‘That's wrong, and ….’ That’s a White person coming at me, so sometimes–

Interviewer: For saying Black?

Mackenzie: People don't like that I call people Black. I prefer to be called Black.

Even though she was visibly identifiable as a person of color, this student had been shushed by a White student for merely saying the word “Black.”

**Feelings about race.** The mid-semester survey showed two significant changes on the following prompts:

- My race is an important part of my identity.
- When interacting with others, I think about their race.
- My opinions about race-related issues differ from those of my family and friends.

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations n=14</th>
<th>Statistics for Teachers n=10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group Average (Pre)</td>
<td>Group Average (Post)</td>
</tr>
<tr>
<td></td>
<td>Group Average (Post)</td>
<td>Avg. Paired Difference</td>
</tr>
<tr>
<td>Race ID (self)</td>
<td>2.79</td>
<td>2.71</td>
</tr>
<tr>
<td>Think Race (others)</td>
<td>2.43</td>
<td>2.21</td>
</tr>
<tr>
<td>Different Fam/Friends</td>
<td>2.57</td>
<td>2.29</td>
</tr>
</tbody>
</table>

*p < 0.1; **p < 0.05; ***p < 0.01, based on one-tailed hypothesis test (Likert scores, 1 through 4; 2.5 is neutral)“Group Average” is for pre-post matched completers only

The most significant result in the *Social Foundations* class was a decrease in differences of opinion on race-related issues with family and friends. This difference became statistically significant because there was no student who increased on this measure (making the spread in
the set of differences was very small.) Even though it was statistically significant, the small effect size should make us cautious in reading too much into this change.

Two of the four students who decreased on this measure were interviewed. One was Ally, both of whose parents are teachers. She spent the semester observing in her father’s classroom in a low-income, predominantly Arab community. She said:

I've noticed when I'm in their classrooms, they, there is no race barrier with my dad. My dad's one of the only White teachers in the building. I think it's kind of brought me realization that I shouldn't be afraid to talk about those race differential things. Yes, sometimes I might not know what to specifically call a typical race group. I don't want to offend anyone, but I don't think I should be afraid to talk about it. … Then I've also, I've not just observed in his classroom, I've been in other classrooms. They have noticed, they said that they came, when they went to school it was very hush, hush about race related topics. Now, they're learning in that school district, or maybe in general that ... everyone knows almost everyone on what they're going through.

Sometimes it's better to just say out in the open.

Ally also reflected on her participation in equity-related discussions in college classes, saying that, “Poverty I'm starting to get more comfortable with as we're going on in the class. There's still some things with gender and race that I'm sometimes a little bit hesitant on.” It appears that her level of comfort discussing race was somewhat situational.

Paige, too, had moved toward her family and friends in this area. It is notable that, although she has three adopted, mixed-race brothers, she had still experienced the topic of race as being taboo in her family. She said that taking the Social Foundations class had helped her broach this subject:
Now I want to talk about it all the time and so I'm realizing that my friends and family have some similar views that I thought maybe they didn't share …

I think like, you know, race and equity and poverty and all those things are like kind of taboo topics – and people don't really want to like talk about them and it's kind of like do we bring it up? Do we not bring it up? And so, then, when you have that sort of like awkward limbo with the people you're close with, you feel like okay, maybe we like differ and so I'm just going to not. But now I'm like okay. I'm going to talk about it and I don't care if you're uncomfortable and so then I'm realizing like oh. Okay. We actually agree on this. (March 12, 2019)

In these two examples from the Social Foundations class, the pre-service teachers were not actually in the kind of caught-in-between position described by Case and Hemmings (2005); rather than having been silenced by a racist family environment, they had simply been swept along by the White, middle class cultural taboo around discussing race. However, for the other two respondents who declined to be interviewed, it is difficult to know why or in what way they had gained common ground with their families and friends over the course of the semester.

The responses of the Statistics for Teachers group to the prompt, “When interacting with others, I think about their race,” changed significantly, reflecting an increase in mindfulness of the race of others. This result was not explained in the interviews, due to lack of time. However, it seems plausible to attribute the change to the several Statistics for Teachers lessons that focused on race-related issues. It is also consistent with the changes in that group’s conceptions of equity in education, to which we now turn.

**Meaning of equity in education.** The survey prompt exploring the pre-service teachers’ conceptions of equity read, “Which most closely describes the meaning that equity in education
has for you? If none of these descriptions come close, please describe what educational equity means to you in the field that says 'Other'.” The paired responses to that prompt are summarized below. (Unpaired group results had similar trends.)

Table 10: Meaning of Equity in Education (Pre-Post Responses)

- **A.** Equity is the same treatment for everyone so that all students have an equal chance to meet the same standards and an equal opportunity to master those standards.
- **B.** Equity is investing in students most at-risk, those whose success or failure in life depends on their school experience.
- **C.** Equity compensates for social injustice to specific groups of students who have not received fair treatment or a fair share of the resources by giving preference, when all else is equal, to underrepresented groups.
- **D.** Equity involves a safety net for individual differences (backup programs, differentiated curricula, and other resources) so that when one program does not work for a particular student, other options are available.
- **E.** Equity involves maximum return on investment: a concentration of scarce resources on those students who are most likely to succeed.

n=14
no statistically significant changes
Professor Carter’s comments at the end of the semester triangulate well with these results, based on the papers and assignments that the Social Foundations students submitted. Without having seen these survey responses, Professor Carter identified students’ definitions of educational equity as a weak area in their growth over the semester. In his interview he reflected that “there’s still some confusion between equality and equity or abstract equality and equity. It's not uniform, but it's evidenced enough in the papers such that it doesn't show a serious change in thought.”

However, significant pre- to mid-semester changes were evident on the Statistics for Teachers survey. There was a large increase in the percentage of student who chose, “(C) Equity compensates for social injustice to specific groups of students who have not received fair treatment or a fair share of the resources by giving preference, when all else is equal, to underrepresented groups.” While this conception of equity is somewhat narrow (consisting mainly with the principle of affirmative action), it reflects an understanding that groups of students, rather than just individual students, have not been treated fairly in our educational
system. The corresponding decrease in the choice of “(A) Equity is the same treatment for everyone so that all students have an equal chance to meet the same standards and an equal opportunity to master those standards” also reflects a shift away from an individualistic, colorblind, gender-blind conception of equity. Henry was one of the Statistics for Teachers students who changed his response from (A) to (C). In Henry’s interview, he explained:

Honestly, I wish that these two were combined, the original one that I said and the one that I recently put because the first one that one is solid but it just isn't specific enough for me. It makes me think that they might leave people out if they choose that one. Then the one that I recently put that one is more specific to a group that is, like they said, underrepresented.

Steven, another Statistics for Teachers student, changed his response from (D) to (C) because, “I think (D) just seems more like kind of like putting out a fire ... (C) seems like you're preventing the fire instead of just waiting for the fire ... and putting it out, that makes sense.” When asked for an example, he elaborated this further:

For example, if you have a school district that's struggling with money and you know that some of the students aren't getting proper attention, instead of just setting up afterschool programs that they could attend to, if they wanted to … I think (C) would more take care of that in the classroom and kind of help the students work through their problems that they may be having at home while still getting them the education that they need.

These two students did not identify a particular lesson or exercise in the Statistics for Teachers class that had influenced their change in thinking. However, Henry’s response may point back to the data that the class had explored on race-related tracking in secondary STEM classes. Steven seems to have been drawing on the idea of structural causes of educational
“failure,” such as inequity in school funding; he also alludes to the idea that education can reach beyond the walls of the classroom, as explored in the lesson on “Teaching Statistics for Social Justice.”

**Fairness in Education.** Paired pre-post responses to the “unfairness” prompts are summarized below, in Table 11.

Table 11: Unfairness of Current Educational System (Pre-Post)

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations</th>
<th></th>
<th>Statistics for Teachers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=14</td>
<td></td>
<td>n=10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group Average (Pre)</td>
<td>Group Average (Post)</td>
<td>Avg. Paired Difference</td>
<td>Group Average (Pre)</td>
</tr>
<tr>
<td>Students w/ Disabilities</td>
<td>3.00</td>
<td>3.36</td>
<td>0.36**</td>
<td>3.30</td>
</tr>
<tr>
<td>Economic Disadv.</td>
<td>3.29</td>
<td>3.50</td>
<td>0.21</td>
<td>3.60</td>
</tr>
<tr>
<td>English Learners</td>
<td>3.14</td>
<td>3.43</td>
<td>0.29**</td>
<td>3.50</td>
</tr>
<tr>
<td>Segregated Schools</td>
<td>3.43</td>
<td>3.36</td>
<td>-0.07</td>
<td>3.20</td>
</tr>
<tr>
<td>Integrated Schools</td>
<td>3.00</td>
<td>3.07</td>
<td>0.07</td>
<td>3.20</td>
</tr>
<tr>
<td>Females in Math</td>
<td>2.21</td>
<td>2.86</td>
<td>0.64***</td>
<td>2.20</td>
</tr>
</tbody>
</table>

*p < 0.1; **p < 0.05; ***p < 0.01, based on one-tailed hypothesis test (Likert scores, 1 through 4; 2.5 is neutral)

“Group Average” is for pre-post matched completers only

**Students with disabilities.** Since the Social Foundations course did not explicitly address disabilities, it is difficult to explain the significant increase in feelings of unfairness to students with disabilities. One Social Foundations interviewee discussed why she changed her response from “strongly disagree” to “agree” because of what she had learned during the semester about disparities in special education resources. The following excerpt from her interview points toward an increased awareness of *economic* inequity as the indirect cause of her changed opinion:
Lucy: Yeah, so I don't think we have enough extra help in the school systems. Like my mom was a Title One aid. So she worked with the kids that had the struggles. So, you know, I guess based on what we're learning in class, I realized not all those schools have that.

Interviewer: I see.

Lucy: Yeah, so I grew up thinking, ‘Oh, that's normal in school,’ and now I'm like there's schools that don't have it, they can't afford the extra help.

Interviewer: So, you grew up thinking that everyone, every school had accommodations for people with disabilities so why would it be unfair to people with disabilities?

Lucy: Right.

Thus, it may be that what Lucy had learned was not about the treatment of students with disabilities across the board, but in impoverished schools in particular. In conjunction with this, consider the Social Foundations class’ response to the statement, “Our current educational system is unfair to economically disadvantaged students.” Note that, while the increase in the class’ agreement with the statement did not reach statistical significance, this may have been due to a ceiling effect, since the initial agreement with that statement was already very high.

**Economic inequity.** Another surprising result was the decrease in agreement with the statement about economic inequity in the Statistics for Teachers class. Economic inequity in education was explored in the class: one in-class data exploration had revealed that in every U.S. state the graduation rate for low-income students is below the overall graduation rate. However, in another data exploration the pre-service teachers had discovered that per-pupil revenue is approximately equal for high-poverty and low-poverty districts in most states. This fact was not deeply explored: in one lesson, pre-service teachers were told that it costs more to educate
students in poverty than it costs to educate other students, but the reasons for this were not given. Furthermore, in that particular lesson, the issue of poverty was overshadowed by the larger issue of race-related funding disparities that exist in Pennsylvania. Pre-service teachers discovered that districts with above the median percentage of students of color generally receive less than the amount dictated by the state’s “fair funding formula,” while for districts with fewer students of color the opposite is true; this is the case even when comparing districts with equal poverty levels (Mosenkis, 2016).

In spite of the decreased response to the prompt about economic inequity in the Statistics for Teachers class, note that the mid-semester responses were still commensurate with responses to all other “unfairness” prompts (except for the one addressing gender inequity in mathematics education). Note also that the pre-semester agreement with the statement about economic inequity in the Statistics for Teachers class was the strongest of any prompt in either class at either point in the semester; thus, in spite of the decrease, the end point was still one of moderate to strong agreement. One interpretation of the change in the Statistics for Teachers class might be that those students became more aware of other sources of inequity in education that play important roles as well.

A less encouraging interpretation comes from the fact that the pre-service teachers were concurrently engaging elsewhere – perhaps less productively – with issues of socioeconomic status and education. Cameron, the only decreaser on this response in the Statistics for Teachers course who consented to be interviewed, said regarding his pre-semester response, “I'm thinking it was just an impulse decision, I was like, I think this ... I strongly agree that it's unfair.” Regarding his weaker mid-semester response of “agree,” he said, “I was like, well it's kind of unfair but it's not ... it's up the student as well what happens in the classroom, so I don't know.”
This reflects a shift toward the mainstream idea of the U.S. educational system as an individualist meritocracy – an idea that is popular among practicing teachers (Milner, 2012). Consistent with this shift was Cameron’s mid-semester decision to include “students themselves” in his response to the prompt, “Which factors are most responsible for ensuring children’s educational success in the U.S.? (select your top 4, in order of importance),” while he had not included that item on the pre-semester survey.

Cameron was concurrently observing classes at a school in his home town of Lakeford, which he described as having provided him with opportunities and a good education. (Lakeford High School was ranked in the top 5% of all schools in the nation by *Newsweek* magazine in 2009; it is located in one of the ten highest income counties in the United States with populations over one million people.) On the mid-semester survey, Cameron also changed his response to the statement that “some cultural or socioeconomic groups value education more highly than others,” from “strongly disagree” to “agree” – a notable shift in opinion. When asked why, he said:

Maybe I wasn't considering experience when I was selecting the first one. Maybe in the first one I was more thinking of it in general terms as like, well I'd like to think everyone values education more. I like to be very optimistic about people and just give people the benefit of the doubt, like yeah, they value education more. Then I said I somewhat agree because I think you can't always be so optimistic and you can't always – I don't know. You need to also be realistic at the same time, as well as being optimistic….

Socioeconomically, I think that kids in – I don't have as much knowledge but I have an interaction with them, kids in more [urban] areas that don't have as much opportunity, I think they value education more, but culturally, they’re in this – I don't know, what are
my friends interested in? If my friends aren't interested in education and not dedicated, then I might not be as dedicated and not interested.

Cameron’s change in thinking on how much value is placed on education in different socioeconomic groups was also a move toward the mainstream view that working class and poor people do not value education as much as middle class communities (Gorski, 2018; Payne, 2003). From this view it follows that, if students in poverty do not succeed in school, it is partly due to deficiencies in themselves and their community. Logically, then, the changes in Cameron’s responses go hand in hand. As we will see, below, pre-service teachers who are observing in classrooms do converse with their mentor teachers about these issues and may be influenced even more by the accepted ideas in those settings than by what they are learning in their university classes.

**Female students in mathematics.** One other result bears further examination here. Both the Social Foundations class and the Statistics for Teachers class significantly increased their agreement with the statement, “Our current educational system is unfair to female students in mathematics.” On the pre-semester survey, this was the only “unfairness” question on which the majority of students disagreed with the statement (see Table 11). Furthermore, when the data from both classes was pooled, there was a gender gap in agreement with the statement (42% of females and only 17% of non-females). By mid-semester, this situation had changed dramatically in both classes: there was 63% overall agreement with the statement and the gender gap had disappeared.
Table 12: Unfair to Females in Mathematics, Pre-Post (unpaired, binary response, classes combined)

“Our current educational system is unfair to female students in mathematics.”

- 33% overall agreement (42% of females and 17% of non-females).
- Significant difference of proportion of agreement, with p < 0.1
- 63% overall agreement
- No evidence of a difference of proportion, female to non-female

Again, the reasons for this change are not immediately obvious, since neither course directly addressed gender inequities in mathematics education. One clue to this puzzle comes from Steven, a Statistics for Teachers student who participated in both rounds of interviews. On the first survey, he had disagreed with the statement about gender inequity in mathematics education. In the follow-up interview for that survey, he commented that, “the survey was really, I don't know, it was kind of interesting to actually take, and kind of sit and think through a lot of these answers. Because, I mean, you don't really get asked these questions very often at all.” This may indicate that the survey itself prompted him to begin to take notice of what was happening to female students in his mathematics classes.

On the mid-semester survey, Steven agreed with the statement about gender inequity in mathematics education. In the follow up interview, he was asked to explain why his opinion had changed. He began by saying, “I have a lot of friends in math, and most of the time I only see my
male friends actually go through with it, and get further in math, and my female friends tend to not. I don't know why that really is, though.” When pressed to guess why this was happening, he said, “Unfortunately, I think most of the teachers are male that I have for my math classes, and I think that sometimes they don't take the female students seriously.”

Of course, the significant swing in opinion may also have reflected an investigator effect: the mid-semester responses may have been influenced by my own presence in the classes and my role as the researcher. Even though I was briefly introduced before the first round of surveys as a female mathematics educator interested in equity issues, I had not yet developed the level of rapport with the students that I had at mid-semester. Thus, it is impossible to determine the extent to which opinions would have changed without this influence.

Something similar should be mentioned about the change in the Social Foundations students’ agreement with the statement that “Our current educational system is unfair to students learning English as a second language.” Although the course instructor was not directly involved in the research for this study, it was known that he was a professor in the researcher’s field of study. During the semester, he spoke several times about his personal experiences teaching Spanish-speaking students near the U.S.-Mexico border, and about the marginalization that his students and their families experienced. This may have influenced the response to that prompt.

In both of these cases, however, the possible investigator effect is inextricable from the social nature of the learning process in which the pre-service teachers were engaged. Developing warm relationships with a female researcher in mathematics education and a course instructor who was a passionate advocate for his Mexican American students may have in fact led to true learning, rather than merely biasing the survey responses toward answers calculated to please
these two individuals. Teasing apart these effects would require more repetitions of this study under a variety of circumstances.

**Structural and Individual Factors in Education.** The importance that the pre-service teachers placed on various factors that might influence children’s educational success was measured by the following prompt:

- Which factors are most responsible for ensuring children's educational success in the U.S.? (select your top 4, in order of importance.)

Responses to this prompt were scored by assigning four points to the respondent’s first choice, three points to her second choice, two points to her third choice, one point to her fourth choice, and no points to the remaining four options that were not included on her list. The results were simplified by combining several of the options into two broader categories of individual factors and structural factors. The two factors that were categorized as “individual” were (1) parents/caregivers and (2) students themselves. The highest possible score for this category would therefore be 7. The four factors that were categorized as “structural” were (1) schools and districts (leaders and policy), (2) state and federal government (leaders and policy), (3) media and American cultural leaders, and (4) educational researchers and curriculum developers. The highest possible score for this category would be 10, if the respondent chose all four structural factors. The remaining two options, teachers and communities/cultural groups, were analyzed on
their own\(^4\), and therefore had a highest possible score of 4. Table 13 shows a pre-post analysis of the responses to this prompt.

Table 13: Factors Responsible for Children’s Educational Success (Pre-Post)

<table>
<thead>
<tr>
<th></th>
<th>Social Foundations</th>
<th>Statistics for Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group Average</td>
<td>Group Average</td>
</tr>
<tr>
<td></td>
<td>(Pre)</td>
<td>(Post)</td>
</tr>
<tr>
<td>Individual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2 factors)</td>
<td>5.14</td>
<td>3.79</td>
</tr>
<tr>
<td>Structural</td>
<td>1.71</td>
<td>2.86</td>
</tr>
<tr>
<td>(4 factors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community</td>
<td>0.43</td>
<td>1.00</td>
</tr>
<tr>
<td>(1 factor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td>2.64</td>
<td>2.36</td>
</tr>
<tr>
<td>(1 factor)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Avg. Paired Difference</th>
<th>Avg. Paired Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>-1.36***</td>
<td>0.60</td>
</tr>
<tr>
<td>Structural</td>
<td>1.14***</td>
<td>-1.10**</td>
</tr>
<tr>
<td>Community</td>
<td>0.57</td>
<td>-0.20</td>
</tr>
<tr>
<td>Teachers</td>
<td>-0.29</td>
<td>0.7**</td>
</tr>
</tbody>
</table>

*p < 0.1; **p < 0.05; ***p < 0.01, based on one-tailed hypothesis test (scores out of 10 available points: 4 points for first place, 3 for second, etc.)

“Group Average” is for pre-post matched completers only

In the Social Foundations class, there was a very significant change in individual and structural attributions for educational success: a decrease in individual attributions and a corresponding increase in structural attributions. This aligns well with the focus of the course, especially the Gorski (2018) text, *Reaching and Teaching Students in Poverty: Strategies for Erasing the Opportunity Gap*. Gorski’s purpose is to counteract the fact that “much of the available literature … misinterprets educational outcome disparities as reflections of the supposedly deficient cultures, mindsets, and grittiness of families experiencing poverty. … We

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\(^4\) Teachers were analyzed separately because their role may be interpreted as either individual (from their own viewpoint) or structural (from the viewpoint of students and families in marginalized communities). Furthermore, pre-service teachers’ perspectives on the role of teachers was important to examine alone because it positioned them as the object of their own analysis. Communities/cultural groups were analyzed separately because their categorization as either individual or structural could be contested. Marginalized communities are targeted along with individuals in the mainstream meritocratic discourse; however, communities are not individuals, and may be viewed as a structural force constraining individual action.
begin by fixing students and families experiencing poverty rather than by fixing the inequities they experience” (pp. 3-4). In contrast, Gorski (2018) says, a structural view of poverty “emphasizes the importance of understanding how societal barriers – including barriers students experiencing poverty face outside of schools, like disparities in access to health care and affordable housing – impact student engagement and performance (p. 10). Professor Carter regularly used sociological language in guiding discussions around this and other texts, making references to social patterning instead of individual choice.

In the Statistics for Teachers class, the mid-semester responses actually reflected a decrease in structural factors. This might be explained, in part, by outside-of-class factors such as classroom observations. (For example, recall Cameron’s decreased certainty that our educational system is unfair to economically disadvantaged students, along with his increased emphasis on individual factors, described above.) An alternative explanation might be the fact that this survey question forced a choice between these structural factors and the importance of teachers. The importance of teachers increased significantly, for the Statistics class, and something had to give way to this on their survey responses. This forced – and possibly false – dichotomy will be discussed in more depth below.

It is evident that the Statistics for Teachers class had an effect on the pre-service teachers’ sense of their own importance to the success of their students. The course placed a heavy emphasis on simulations of practice, where pre-service teachers submitted video recorded and written responses to different classroom situations presented to them. They received detailed feedback on these simulations of practice. In addition to this, every major statistics topic covered in the course included real examples of student work from middle and high school statistics lessons. During class, the pre-service teachers were asked to brainstorm and discuss possible
responses to this student work, in small groups and as a whole class. Finally, several in-class and homework assignments asked the pre-service teachers to imagine and flesh out possible lesson activities for their future students.

In the last category were two activities related to social justice and student activism: one based on a community-led initiative to decrease diesel truck traffic in a low-income neighborhood (“Counting trucks,” 2017), and one based on a nonviolent student protest over the closing of a neighborhood high school (EMEACGreenScreen, 2012) in Detroit. The latter situation was fleshed out in the course materials using footage of the protest along with an animated film created to simulate a possible classroom discussion following up on the protest. Both were real-life events, and the pre-service teachers had to imagine ways of using their statistics lessons to equip students for more effective activism. This was followed by a discussion of the pedagogical practice of Rico Gutstein (2007), who teaches mathematics at a social justice focused high school in Chicago, basing his theoretical approach on the work of Paulo Freire (1996).

The mid-semester interviews did not point to any specific Statistics for Teachers lesson that had increased pre-service teachers’ sense of teacher importance and/or efficacy. Rather, this change may have been the cumulative effect of the overall course content and pedagogy, much like the change in individual vs. structural attributions in the Social Foundations class, which appears to have resulted from the overall thrust of the course rather than from one particular element.

**Value placed on education.** As explained in the Methods section, the prompt, “Some cultural or socioeconomic groups value education more highly than others” was kept on the survey, even though the first round of interviews showed a weakness inherent in the question
phrasing. Rather than replacing that question, another question was added: “Generalizing from your knowledge and experience, how much do the following types of families value their children’s education?” The mid-semester results for this prompt are summarized in Table 14.

Table 14: Estimation of Value Placed on Education by Families (post only)

Results for the two classes were remarkably similar. To a dismaying degree, they reflect mainstream stereotypes of families in poverty, African Americans, and Latinx people. Contrast the opinions of these pre-service teachers with the responses given by actual family members, on the General Social Survey (T. Smith, Davern, Freese, Hout, & Marsden, 2018), summarized below:
Table 15: General Social Survey Responses, 2016

Question: Local school issues. (Are you very interested, moderately interested, or not at all interested?)

<table>
<thead>
<tr>
<th>Incomes</th>
<th>Very interested</th>
<th>Moderately interested</th>
<th>Not at all interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-$25K</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>$25K-$50K</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>$50K-$75K</td>
<td>30%</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>$75K-$130K</td>
<td>35%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>$130K+</td>
<td>40%</td>
<td>40%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Question: I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them? … D. Education

Based on the follow-up interviews, pre-service teachers’ ideas about the extent to which families value education come from several sources. Personal experiences with Asian classmates were often cited (though interviewees were often silent on the fact that they had ranked White
families the same way); one pre-service teacher generalized an experience with one Latinx co-worker to the entire Latinx population. Other, quasi-psychological explanations went along the following lines:

And I feel like Latino and African American students just have a little bit more to worry about, especially everything that's going on in the world right now. So they don't quite…

value education. So that's kinda why I feel like they don't value education as much, because there's just too much other stuff in the world going on for them to worry about education. …

In terms of income, I feel like the zero to $25,000 was kinda the same scenario, the students, the family has too much to worry about so education isn't quite as important. They're more worried about where they're gonna get their next meal. And 25 to $75,000 was moderate because they should potentially be able to get their next meal, but they might not have the leisurely of being able to de-stress in St. Thomas or wherever they want to go for vacation. And then 75 to $130,000+, they can live comfortably and go to school and they tend to care a little bit more because they don't have anything else to worry about in their life. (Steven, March 7, 2019)

Steven had not come up with this idea on his own. He explained that, “I just took a class that talked a lot about all this last semester, so it's kind of interesting to take a class that I didn't think would be related to it, and it's actually playing a lot more into equity and everything than I thought it would.” Other interviewees also mentioned classes that had influenced their thinking on the prompt, “Some cultural or socioeconomic groups value education more highly than others.” All of these classes had contributed to a logical-sounding explanation for why families
in poverty and people of color value education less than others; no class previous to this semester had caused them to question this idea.

Another important insight comes from part of Troy’s interview, transcribed below:

Troy: I’m actually in two different schools, so it's a really cool situation. I'm in Boxerville, which is like – I would consider a higher socioeconomic status, versus Turner.

Interviewer: Okay.

Troy: And, um, I feel like it's unequal the amount of kids that are – and their resources and their like willingness to like want to learn but there is like an equal amount of kids that just don’t care. You know what I'm saying?

Interviewer: Mmm, interesting.

Troy: Like, they might have knowledge and not just care about school at all. Whether – I don't know what those influences are, but I feel like in both settings I still see kids that just may not care, you know?

Interviewer: Interesting. And you think it's about the same proportion in both?

Troy: Um, maybe not the same proportion…. There's just kind of the – maybe the kids that just don't care about school, you know, and that's their thing. And that's what I've noticed in my observations.

Interviewer: Okay. So, it tends to be peers, a group of peers that all act that way?

Troy: Yeah. Maybe it’s not – maybe in the – Turner, where it's a lower socioeconomic status there's, um, more kids, because there's not like a big emphasis on education, where there’s still that group in Boxerville, but there's these expectations that I talked about with
the teacher. There's just – overall like the school is part of your responsibility, to be, um, good at school. You know what I'm saying?

Interviewer: Okay, whose expectations? The parents or the teachers or the kids?

Troy: The community, I feel like. It's all of them put together.

Interviewer: Okay.

Troy: So – where, in Turner, I don't see those expectations like that, you know? …

Troy: I even talked about it with a teacher today. He said, "Our job is to get these kids in the world and be productive," where at Boxerville you talk and they – their job is to like get them to higher education.

Interviewer: Interesting.

Troy: So, he was talking about the clientele that they serve.

On Troy’s pre-semester survey, he had disagreed with the statement that “Some cultural or socioeconomic groups value education more highly than others,” but at mid-semester he changed that response to “agree.” It appears that his interactions with the teachers in Boxerville and Turner had influenced that change.

A few students did change their responses to the prompt, “Some cultural or socioeconomic groups value education more highly than others.” Savannah, a Social Foundations student, changed her response from “agree” to “disagree.” She attributed this change to the Michie (2012) course text, We Don’t Need Another Hero: Struggle, Hope, and Possibility in the Age of High-Stakes Schooling, where she had learned that parents in poverty value education just as much as other parents (March 12, 2019). She was one of two students in Social Foundations who indicated, on the mid-semester survey, that all racial and socioeconomic groups valued education “highly.”
Melanie, a student in *Statistics for Teachers*, responded in this way also. She said that she had been prompted to question her previously held stereotypes by one of the lessons in the course:

Interviewer: Okay. So what, so is there anything that happened this semester, like in one of your classes that got you thinking along those lines?

Melanie: This semester? I'm trying to think. No, I actually think that Stats is the only class I've had even like mentioned social justice because I'm in all other math classes and psychology but doesn't really touch on that. So this is the one class that's attempted to discuss it. So and we did, it was when we did the income levels of the White versus Black and just seeing like, what, who's stuck in the poverty levels and the changes and things like that. Like seeing that and it just was really, it was actually really sad to see but was like needed to be seen.

Interviewer: Was that the moving [data] visualization, where the dots were going across the screen?

Melanie: Yes, yeah and the trends were clear that those were black and poor tended to stay that way where as whites seemed to have a chance to move, where if they started off wealthy, like whites stayed that way but it seemed like the black men seemed to drop, so sad, yeah.

The use of the data visualization to which Melanie referred (Badger et al., 2018a) will be discussed further in the Recommendations section.
Discussion

The Meaning of Equity

As we move toward a framework for understanding these results, the issue of unfairness to females in mathematics can serve as a useful starting point. In the interviews that followed up on the pre-service teachers’ increased agreement with the statement about gender inequity in mathematics, male and female respondents had different kinds of explanations for their changed opinions. Male respondents had to rely on their observations of their female classmates, rather than on their own experiences of mathematics education. Cameron explained his change from “disagree to “agree” this way:

The only thing I can think of is when I was thinking I somewhat disagreed with it earlier is because there are programs and opportunities coming about STEM and girls in STEM. I know, as I was leaving high school, junior or senior year, there were STEM programs for females and they were encouraging that so that was really cool to see. However, as I go into college you see how many girls are in the Mathematics field, who are in actual hands on engineering and things like that. I've had friends who are girls, who are going in engineering but then something disconnects along the way.

His initial feeling that no inequity existed was based on the STEM programs for girls in his high school. This might be categorized as a “fairness” view of equity (Makar, 2004), in that it attempts to repair past wrongs against a previously excluded group. Cameron’s changed opinion was based on an observed inequality of outcomes, reflecting view of equity which currently has a very high profile in the public discourse. Recall, from above, how the National Council of Teachers of Mathematics’ (NCTM, 2014a) operationalizes the concept of equity:
When access and equity have been successfully addressed, student outcomes—including achievement on a range of mathematics assessments, disposition toward mathematics, and persistence in the mathematics pipeline—transcend, and cannot be predicted by students’ racial, ethnic, linguistic, gender, and socioeconomic backgrounds. (n.p.) However, an equality of outcomes was not the main concern of the female students who were interviewed. Melanie said that “in my [high] school there was actually pretty equal representation … like the course that accelerated and things like that for men versus women.” But she felt that her experience of high school math classes had been inequitable:

Melanie: I felt like – no, I knew I was just as smart as these boys, or I was doing better than them but it was like they were just a lot more competitive and the teacher would hold them to higher standards. I remember the teacher being like, so excited for them when they would figure things out but was like, here I am doing it too, and it just wasn't the same. …

Interviewer: Do you feel like they kind of ignored you more or did you hold back because you were, you felt like you couldn't break into the conversation?

Melanie: It was a little bit of both, it was almost like, maybe they were ignoring in the sense that they weren't looking for you and then like me holding back, it was almost like ... I'm not as, I don't know I wasn't as competitive about it. Or like I didn't … have arguments and like guys would get upset if you were beating them in something.

For Melanie, then, equality of outcomes was not a sufficient measure of educational equity. She “was doing better than [the boys],” but she was not included in the classroom conversation, and her values were ignored in tying mathematical learning to competition. This illustrates the need to ask a very fundamental question: How is equity in education conceptualized in the dominant
discourse? More importantly, does this match the conceptualizations of marginalized people themselves?

In order to analyze this question, we can draw a parallel with Lister’s (2004) careful analysis of the ways in which poverty is conceptualized in contemporary societies:

Concepts of poverty have practical effects. They carry implicit explanations which, in turn, underpin policy prescriptions. The emphasis placed upon socio-economic structural conditions, power relationships, culture and individual behavior varies. The policies developed to tackle poverty reflect dominant conceptualizations. (p. 3)

For Lister, conceptualizations are broad meanings and understandings that are reflected in how people talk about and visualize poverty. These meanings provide a framework for definitions and measures of poverty. A definition is a precise statement of what distinguishes a state of poverty from a state of non-poverty: for example, “having insufficient resources to meet socially recognized needs and to participate in the wider society” (p. 4). A measure is the quantitative operationalization of a definition, used to identify and count those in poverty and the gauge the depth of their poverty. Measures follow from definitions, which follow from conceptualizations.

These distinctions are helpful in discussing definitions of educational equity. It would be easy to say that educational equity means that all students have an equal opportunity for educational success. But this begs the question, what is educational success? Can we satisfactorily operationalize success using quantitative measures? If so, who chooses these measures? Lister (2004) urges the importance of this question in discussions about poverty: Measures, which are constrained by limitations of methodology and available data, may be treated as definitions. The result is that measurement is in danger of becoming a substitute for analysis, so that “omitting the conceptual level can encourage a myopic, technocratic approach
that, in its preoccupation with measuring poverty’s extent and depth, overlooks how it is experienced and understood” (pp. 6-7). She goes on to say that local people in participatory poverty assessments highlight non-material aspects: lack of voice, disrespect, humiliation and powerlessness, denial of rights and diminished citizenship. These conceptualizations of poverty are noticeably similar to Melanie’s understanding of educational inequity in her high school math classes – and they are equally difficult to measure.

When those in power are allowed to define and choose the best, clearest, or most scientific measures of educational equity, they have already succeeded in exerting their dominance. In Danny Martin’s (2015) words:

This form of education, one that is rooted in appeals to White rationality and White benevolence, is a colonizing form of education, not a liberating education or an education characterized by equitable access to opportunity. For example, framing mathematics education solely in service to college and career readiness, for example, glosses over the commodification of students as future workers in favor of their participation in a system that has long oppressed many of them. (p. 21)

Nel Noddings (2012) frames this idea from a feminist perspective:

A gender-blind approach would, by default to the status quo, be an approach constructed for and by males – technically open to both males and females without discrimination. Thinking of this sort led to questions about why women lagged behind men in mathematics and science. The accepted answer was discrimination, and the remedy was to encourage – even push – young women to take more math and science courses in high school and college. Policymakers and educators, eager to escape the charge of
discrimination, did not think to ask what young women were interested in, what they want to do. (p. 517)

It is through their research of school and classroom experiences that some feminists have developed their critique of male hegemony, seeing its operation in the interaction of teacher and pupil (Arnot & Dillabough, 1999). But Noddings (2012) also raises another concern, echoing the words of Virginia Woolf: that radical feminism is “ambivalent about joining the procession of educated men without changing the destination of the procession” (p. 516). Arnot & Dillabough (1999) have taken up this concern by questioning the ways in which new social and political formations (e.g., neo-liberalism) structure the relationship between gender and democratic education. Consider, for example, the explicit motivation behind a recent U.S. Department of Education report (Chen, 2013) on STEM attrition (among females, in particular) at the college level:

While the United States has long been held as a world leader in scientific and technological innovation, it is facing fierce competition from abroad in producing and retaining STEM talent … Rising concerns about the ability of the United States to compete in the global economy have led to numerous calls for national efforts to increase the number and diversity of students pursuing degrees and careers in STEM fields. (p. 1)

Such goals for women’s education assume the acceptance of a neo-liberal agenda focused on creating more competitive performances in the market. Questioning this assumption, Arnot & Dillabough (1999) have urged a feminist exploration of the political concepts and everyday assertions being employed within the nationalist discourse of power relations – a discourse that is transmitted through teacher training and the school system, and which privileges particular
concepts of democracy (i.e. liberal individualism) while suppressing questions about the contested nature of national identity and political participation.

Like definitions of poverty, then, mainstream definitions of educational equity may not reflect the feelings of the people inside the marginalized group. Imposed from the outside, a definition of equity or success can become colonizing or exploitative. This consideration must inform teacher preparation programs, as it should also inform the broader national discourse about equity in education. A true conceptualization of equity must be constantly evolving, since the groups being marginalized in our system are always changing. Using a historical framework in designing response choices for the prompt, “Which most closely describes the meaning that equity in education has for you?” is appropriate, in light of this – but it should serve as a springboard for the pre-service teachers’ developing thinking, rather than giving the impression that the “true” definition of equity can be found on the list of response choices.

When debriefing the survey in class, Makar’s (2004) broader categorizations of equity as equality of inputs, equality of outputs, and fairness could be a helpful discussion tool. Each of these can serve as the seed of a present-day conceptualization of equity. None of them is fail-safe; each has potential pitfalls when moving from conceptualizations to definitions and measures. For example, fairness could be operationalized in terms of whether or not quotas for various racial groups in college admissions are being met. This does not reflect true fairness any more than having equal-on-average standardized test scores for different groups reflects true equality of outcomes. But it may be that each of the three starting points can lead to a deep, authentic conceptualization of equity – one that would have, at its heart, the true desires of members of the marginalized groups themselves.
Individualist and Structuralist Viewpoints

Lister (2004) has another important theoretical contribution to make to future iterations of this study. In her discussion of welfare theories, she goes on to problematize the dichotomy between individualist and structuralist approaches. In the U.S., she says, the second half of the twentieth century saw an increasingly polarized debate between those who attribute the causes of poverty to social and economic structures and those who hold culture and individual behavior responsible, with the latter group’s voices increasingly dominant (p. 127). Recall that it was a concern about the dominance of individualist ideologies that prompted parts of the present investigation, including the survey question, “Which factors are most responsible for ensuring children’s educational success in the U.S.? (select your top 4, in order of importance.)” But Lister goes on to say:

A recent development in welfare theorizing aims to transcend the dichotomy between individualist and structuralist approaches. Central to this “new paradigm of welfare” is an emphasis on the capacity of people to be creative, reflexive human beings, that is, to be active agents in shaping their lives, experiencing, acting upon and reconstituting the outcomes of welfare policies in various ways. (p. 127)

While the typical individualist approach has acknowledged the agency of people and communities, it has tended to be a victim-blaming approach that attributes responsibility for poverty to the individual. And, while a structuralist approach emphasizes the heavy constraints imposed by the present socioeconomic order, it has not always recognized that people experiencing poverty can be powerful actors in their own lives and in society; it can lead to a characterization of people as helpless victims to be pitied and, therefore, objectified.
Rather than maintaining the individualist-structuralist dichotomy, Lister (2004) urges us to recognize the complex subjectivity of fellow human beings who are trying to negotiate their lives in the face of adverse circumstances. This insight may help to refine the design of the current study. Rather than attempting to measure pre-service teachers’ position on the individualist-structuralist continuum, we might ascertain the extent to which they recognize the structural barriers that exist while also gauging their sense of agency in pushing back against these barriers.

**Goals for Teacher Educators**

What, then, should be the shared goals of teacher educators in courses dealing with educational equity? The absence of shared goals may leave us continually undoing one another’s work as we attempt to push and pull students in different directions along the individualist-structuralist spectrum. Indeed, the results of this study indicate that the psychological approaches to poverty theory that are being taught to future educators are already at odds with the more sociological approach taken in the *Social Foundations* course. And an apparent conflict has also appeared between the *Social Foundations* course and the *Statistics for Teachers* course: while the *Social Foundations* course increased the importance of structural factors in the minds of the pre-service teachers, the *Statistics for Teachers* course actually appeared to diminish their importance, in favor of an increased feeling of teacher efficacy.

As hinted earlier, this is an unfair choice. In their analysis of the strengths and weaknesses of various sociological theories of education, Fitzclarence and Giroux (1984) pointed this out. For example, the reproductive theory of schooling, illustrated so powerfully by Anyon (1980) had unveiled the power of dominant groups outside of schools, whose ideologies and interests work primarily through the hidden curriculum schooling. This made evident some of the
ways in which class and power bear down on classroom social relations, but it ignored the question of how students and teachers produce form of resistance. Another example given in Fitzclarence and Giroux’ (1984) analysis is the theory of knowledge content, which critically interrogated the content of school textbooks – a form of critique essential to unravelling the ideological interests that structure educational theory and practice. However, for Fitzclarence and Giroux (1984), even these “fail to provide forms of analyses that move beyond theories of critique to the more difficult task of laying the theoretical basis for alternative modes of educational theory and practice” (p. 472). Such alternative theories would have to take as their starting point the empowerment of teachers and students, and theorists ought to subject their own theories to the test of how they might become useful in the interest of self-and social determination.

We want to argue that teachers must be seen as intellectuals, as critical theorists who provide the moral and intellectual leadership necessary for developing active forms of community life engaged in the struggle for equality and democracy. In this case, we are referring to teachers who are both scholars and activists, whose sphere of intervention is not just the school but also the community at large, and who take as a starting point for their work the political injunction of working collectively with others to create a more decent and humane world. (Fitzclarence & Giroux, 1984, p. 475)

Thus, the ultimate goal for teacher educators encompasses both the critical awareness that was fostered in the Social Foundations course and the sense of teacher empowerment evidenced in the Statistics for Teachers course.
Westheimer (2015) has analyzed various approaches to civic education in K-12 schools, reaching conclusions that are analogous to this. His characterization of these different approaches is summarized in the chart, *Kinds of Citizens*, reproduced below.

Table 16: Kinds of Citizens (Westheimer, 2015, p. 39)

<table>
<thead>
<tr>
<th>Description</th>
<th>Personally Responsible Citizen</th>
<th>Participatory Citizen</th>
<th>Social Justice-Oriented Citizen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Acts responsibly in the community</td>
<td>Active member of community organizations and/or improvement efforts</td>
<td>Critically assesses social, political, and economic structures</td>
</tr>
<tr>
<td></td>
<td>Works and pays taxes</td>
<td>Organized community efforts to care for those in need, promote economic development, or clean up the environment</td>
<td>Explores strategies for change that address root causes of problems</td>
</tr>
<tr>
<td></td>
<td>Helps those in need, lends a hand during times of crisis</td>
<td>Knows how government agencies work</td>
<td>Knows about social movements and how to effect systemic change</td>
</tr>
<tr>
<td></td>
<td>Obeys laws</td>
<td>Knows strategies for accomplishing collective tasks</td>
<td>Seeks out and addresses areas of injustice</td>
</tr>
<tr>
<td><strong>Sample action</strong></td>
<td>Contributes food to a food drive</td>
<td>Helps to organize a food drive</td>
<td>Explores why people are hungry and acts to solve root causes</td>
</tr>
<tr>
<td></td>
<td>To solve social problems and improve society, citizens must have good character’ they must be honest, responsible, and law-abiding members of the community</td>
<td>To solve social problems and improve society, citizens must actively participate in and take leadership positions within established systems and community structures</td>
<td>To solve social problems and improve society, citizens must question and change established systems and structures when they reproduce patterns of injustice over time</td>
</tr>
</tbody>
</table>

What kind of citizenship should a civics education program aim to foster? Westheimer’s first conclusion is that fostering personal responsibility is not enough: “When we deny students the
opportunity to consider paths for change that involve a critical examination of collective social policy questions (and not just individual character), we also betray an important principle of democratic governance: the need for citizens to be able to engage in informed critique and make collective choices” (Westheimer, 2015, p. 45). Teacher education programs have been similarly admonished (see, for example, H. Giroux & McLaren, 1986) but this vision has yet to be fully realized.

Westheimer (2015) then describes two of his own studies that documented the outcomes of different school civic education programs, much like the present study is documenting the outcomes of teacher education courses. In the first program, the Madison County Youth Service League, students had to collect and analyze data, interact with government agencies, write a report, and present their findings in a formal hearing before the county’s Board of Supervisors. Surveys administered before and after participation in the program demonstrated that students gained confidence in their ability to help others and support community development. However, they did not appear to have examined the underlying political issues related to interest groups and the political process, the causes of poverty, and the ways in which structural rather than individual factors might contribute to poverty. This program had encouraged the development of participatory citizens.

In the second program, Bayside Students for Justice, students examined possible bias in SAT exams, researched child labor practices worldwide, and investigated the dearth of adequate education programs in juvenile detention centers. Survey results from Bayside indicated that students demonstrated greater ability to consider structural explanations for poverty but did not demonstrate gains in their knowledge about particular community groups or about the technical challenges and possibilities that were associated with particular policies and initiatives. This
program had fostered social-justice-oriented citizenship. Westheimer (2015) sums up his findings as follows:

> Our research indicates that engaging in critical analysis does not necessarily foster the ability or the commitment to participate. The reverse is also true: Students can learn to participate without engaging in critical analysis that focuses on macro-structural issues, the role of interest groups, power dynamics, and/or social justice. The ability to spot injustice is not organically linked to the inclination or the ability to take action. … Those committed to educating toward justice-oriented citizenship would ideally want to couple critical analysis of root causes of injustice with opportunities to develop capacities for participation. (p. 67)

This principle applies very well to teacher education, also. The current study has uncovered exciting possibilities for complementarity between the opportunities for social critique presented in a *Social Foundations* course and the possibilities for teacher and student social action examined in an equity-focused *Statistics for Teachers* course. The two types of courses have different constraints: the *Social Foundations* course has students from all teaching majors, so that it would be difficult to address the specifics of teaching for participatory citizenship through a particular content area; the *Statistics for Teachers* course has to cover a great deal of technical content, and cannot demand the amount of reading and analytical writing required for deep, theory-based social critique. Giroux (2015) has commented on the way these two approaches are united in the legacy of Paulo Freire, for whom “pedagogy was central to a formative culture that makes both critical consciousness and social action possible. Pedagogy in this sense connects learning to social change; it is a project and provocation that challenges students to critically engage with the world so they can act on it” (p. 118).
This brings us back, again, to the false dichotomies that may have been implicit in the survey prompt, “Which factors are most responsible for ensuring children's educational success in the U.S.? (select your top 4, in order of importance.)” The decision to force this choice was made in order to prevent respondents from sidestepping issues of structural inequities by saying that all of these factors are very important. However, the unforeseen consequence of this decision was that respondents had no way of indicating their awareness of the need for agency in the face of structural inequities – Lister’s (2004) proposed solution for the individualist-structuralist debate. The Social Foundations students indicated their awareness of structural inequities, while the Statistics for Teachers students indicated their sense of agency as future teachers. In future iterations of this study, then, this prompt should be re-worked in order to better reflect the multi-dimensional nature of students’ development in these areas.

**Teachers, Parents, and Students: A Call to Solidarity**

The last results we will discuss in depth here are the mid-semester responses to the prompt, “Generalizing from your knowledge and experience, how much do the following types of families value their children's education?” Both groups of pre-service teachers answered this question in ways that reflect dominant stereotypes: White and Asian families value education more than African American and Latinx families; upper middle-class families value education more than families in other income brackets, especially more than poor and working-class families.

Undergraduate pre-service teachers are particularly vulnerable to the “voice of experience” that they hear when interacting with practicing teachers. The process of shedding ivory-tower idealism and joining the ranks of the initiated has even been likened, by one anthropologist, to a cultural rite of passage (Head, 1992). This will make it difficult for teacher
preparation programs to effectively combat the culture of low expectations that is entrenched in schools like Turner High School, illustrated so starkly in Troy’s comments (above). An awareness of this dynamic should alert teacher educators to the need to foster critical analysis of the school cultures in which pre-service teachers are immersed prior to their student teaching period. It adds a new dimension to Giroux’ (2015) comment that “experience is crucial, but it has to take a detour through theory, self-reflection, and critique to become a meaningful pedagogical resource” (p. 119).

In this study, the mid-semester interviews did not indicate a sense of animosity or blame towards those families who were supposed to place less value on education; rather, the pre-service teachers made excuses and allowances for the families’ assumed lack of interest. However, the ideological consequences are just as destructive: the cause of educational “failure” is located within marginalized individuals and cultures. Freire (1996) asserts that one myth propagated by any dominant group in order to preserve the status quo is the myth of the industriousness of the oppressors and the laziness and dishonesty of the oppressed. Our more “politically correct” version of this myth is no less effective at preserving the status quo, since it shifts focus away from factors outside of oppressed individuals and groups – factors which will inevitably maintain the status quo in spite of efforts to work on and change those who are “failing.” To make matters worse, one of these factors is the very stereotypes themselves, which are a documented cause of poor academic performance (McGee & Martin, 2011; Steele, 1997). Furthermore, the low teacher expectations to which these stereotypes lead also have documented effects on long-term student outcomes (Boser, Wilhelm, & Hanna, 2014; Gershenson, Holt, & Papageorge, 2016; Papageorge et al., 2018).
The misconception that families from certain racial, ethnic, or socioeconomic groups do not value education has yet another effect: the adversarial relationship it can generate between teachers and families (both students and parents) from these groups. Under our current system of performance-based pay for teachers, families who are presumed not to care about education may become, in teachers’ minds, the reason for teachers’ loss of privileges and financial incentives. Conversely, teachers are targeted and objectified by rhetoric that purports to defend “underperforming” students (115th Congress, 2018, p. 35) against “ineffective” teachers (115th Congress, 2018, p. 165). The mechanistic words used in these descriptions evoke an industrial plant in which both students and teachers are constantly being monitored, measured, and sorted (Giroux, 2015).

Interestingly, the use of this kind of language in speaking about education is not new. As early as 1913, Elwood Cubberly of Stanford University likened progressive schools to “factories in which the raw materials [children] are to be shaped and fashioned into products,” which would demand “continuous measurement of production to see if it is according to specifications” (as cited in Tyack, 2005, p. 90). As dehumanizing as it is to students, Cubberly’s analogy also positions teachers as workers (or robotic machines) on an assembly line. Under these circumstances, what was true for oppressed workers in Paulo Freire’s (1996) context becomes relevant for teachers: “If for a person to be in the world of work is to be totally dependent, insecure, and permanently threatened – if their work does not belong to them – the person cannot be fulfilled. Work that is not free ceases to be a fulfilling pursuit and becomes an effective means of dehumanization” (p. 126).
The industrial model for education had only limited power in U.S. schooling until it was finally codified at the federal level, beginning with the No Child Left Behind Act (107th Congress, 2002). Commenting on the current situation, Giroux (2015) writes:

Teachers have been deskilled. Losing much of their autonomy to be creative in the classroom, they have been relegated to technicians whose sole objective appears to be enforcing a deadening instrumental rationality in which teaching to the test becomes the primary model of teaching and learning. Moreover, they are being demonized by the claim that the major problem with public education is lack of teacher accountability. (p. xii)

If parents and teachers are being demonized, low-income students are certainly demonized as well. Ruby Payne, an “expert” on educating children in poverty, argues that such students often lack the cognitive ability to identify cause and effect. Therefore, “if they cannot identify consequence, they cannot control impulsivity. If they cannot control impulsivity, they have an inclination to criminal behavior” (Payne, 2003, p. 2). In this way and many others, teachers are encouraged to be afraid of their students; they are then told that they must be protected by zero-tolerance policies and armed security officers (Heitzeg, 2016).

In sum, teachers, parents, and students in low-income areas are being set against one another. This is a dynamic which, for Freire (1996), is common to every oppressive system in which the elite few (who may never venture into the physical spaces of the oppressed) wish to maintain control. Thus, a true solution must involve solidarity among all those victimized by the system. “The revolution is made neither by the leaders for the people, nor by the people for the leaders, but by both acting together in unshakable solidarity. This solidarity is born only when
the leaders witness to it by their humble, loving, and courageous encounter with the people” (Freire, 1996, p. 110).

Solidarity and mutual respect between teachers and parents from different cultural and socioeconomic backgrounds might have surprising results, even without overt acts of political protest or civil disobedience. Parents who were previously overlooked as a resource for educational change would be able to contribute more effectively to their children’s success in school (Howard & Reynolds, 2008). Teachers’ demonstration of respect toward these parents could also eliminate children’s need for what Herbert Kohl (1991) calls not-learning in school:

Not-learning tends to take place when someone has to deal with unavoidable challenges to his or her personal and family loyalties, integrity, and identity. In such situations there are forced choices and no apparent middle ground. To agree to learn from a stranger who does not respect your identity causes a major loss of self. The only alternative is to not-learn and to reject the stranger’s world. (p. 6)

This tug-of-war over children’s loyalties and identities has existed since the beginning of public education in the U.S., and was in fact a major impetus for its creation. Fearing that their middle-class Protestant value system was losing its dominance, early advocates of common schooling sought to rescue the nation from the taint of unwelcome influences. Catherine Beecher (1835, in Fraser, 2014) expressed this fear very well:

Thousands and thousands of degraded foreigners, and their ignorant families, are pouring into this nation at every avenue. All these ignorant native and foreign adults are now voters, and have a share in the government of the nation…. How long will it take, at this rate, for the majority of votes, and of the physical force of the nation, to be in the hands of ignorance and vice? … We must educate the nation, or be dashed in pieces, amid the
terrors of the wild fanaticism, infidel recklessness, and political strife, of an ungoverned, ignorant, and unprincipled populace. (pp. 52-53)

When educators are disdainful of children’s families and ignorant of their cultural heritage, children are perceptive enough to realize this. As one Mexican American boy asked his teacher, “What are we, animals or something?” (Kohl, 1991, p. 26)

For teachers and families to remove this barrier to learning by forging true, honest, and respectful relationships with each other would require ongoing and painstaking work. For teachers, it might also require a reconsideration of what schooling means and who should have a voice in deciding that. This, in turn, could lead to some form of resistance against what has become a dehumanizing system for both students and teachers. Westheimer (2015) writes that “most parents believe that teaching is about more than narrow tests of performance on myopic measures of school success. Increasing numbers of teachers … recognize the need to push back against the narrowing of the school curriculum to only those subjects that are under the streetlight” (p. 32).

Marzano and Kendall (1998) estimate that teaching all of the national and state standards and for all subjects in K-12 curricula would take as long as twenty two years. One de facto solution to this has been to cut time from social studies, the arts, and recess; sometimes recess is cut altogether, in particular for those students who are not performing well on tests (Westheimer, 2015). An alternative solution would be for educators to involve the local community in policy and curricular issues in a genuine way. Marzano and Kendall (1998) propose the radical idea of allowing teachers and community members to identify those standards that are most essential for their children – and, by default, those standards that will not be addressed. This is just one
example of a victory for both families and teachers that can only be won once educators have begun to believe in and trust the families they serve.

**Recommendations for the Statistics for Teachers Course**

**Pedagogy**

The first area of recommendation is around pedagogical practices in the *Statistics for Teachers* class. Equitable pedagogy in college mathematics is currently being addressed by a related project: SEMINAL (Student Engagement in Mathematics through an Institutional Network for Active Learning). As members of this project, Matt Voigt (2017) and his team have developed a list of observable equitable classroom practices, reproduced below:

Figure 8: Observable Equitable Classroom Practices (Voigt, 2017, p. 34, numbering added)

| 1) Welcomes students by name as they enter the classroom or calls on each student by name in class. |
| 2) Uses randomized response strategies for calling on students (e.g. rolling dice, computer generated roster name) |
| 3) Uses student’s “heritage” language (e.g. Spanish, Chinese, etc.) |
| 4) Identifies student’s current knowledge before instruction |
| 5) Uses students’ real-life experiences to connect school learning to students’ lives |
| 6) Circulates around student work areas to be close to all students |
| 7) Instructional materials, and other visuals used in the classroom reflect the racial, ethnic, and cultural backgrounds represented by students |
| 8) Uses class building and teambuilding activities to promote peer support |
| 9) Structures heterogeneous and cooperative groups for learning (i.e. random groups, etc.) |
| 10) Acknowledges all students’ comments, responses, questions, and contributions |
| 11) Allows students to revise work based on teacher feedback |
| 12) Explains to students the importance of positive self-talk |

It is important to enact these practices when teaching *Statistics for Teachers* for two reasons. First, teaching subject area content equitably should help foster the development of a more diverse pool of well-prepared teachers. Second, modeling equitable teaching practices in their subject area is an excellent way to train teachers in these practices.
Several of these pedagogical practices were used in the *Statistics for Teachers* class, with immediate results. For example, on the first day of class, field notes indicated that, of the 33 student comments that were made during whole class discussions, only 33% were made by female students even though the class was 54% female. Field notes also indicated that students introduced themselves so briefly that the researcher did not have time to type their names. Professor Ellis did not say students’ names that day when interacting with them that day.

After reflecting on this, Professor Ellis deliberately called students by name on the second day of class and asked several of them to show their work on the projector at the front of the room. On that day, 53% of the 40 whole-class comments were made by female students. The researcher’s field notes on that day noted:

> Participation notes: PE used “cold calling” 4 times, and 3 of those 4 students volunteered answers afterwards. ... Clair did not speak before presenting but volunteered two answers after being asked to present. (Field Notes, Jan. 10, 2019)

However, this was a new and somewhat uncomfortable practice for Professor Ellis. On days when he was tired or had other concerns on his mind, he sometimes did not use students’ names or ask them or share their work. On Day 11 of class, field notes indicated that Professor Ellis had said a student’s name only once and students had not been asked to come to the front of the class to show their work; on that day, 45% of the students in class were female and only 36% of the comments were made by females. Equal female participation was recovered on the following class day when Professor Ellis redoubled his efforts to say names and ask students to share their thinking with the class. Similar results were apparent when Professor Ellis used practice (9); equitable participation and lively discussion were most apparent on days when he used random
grouping. Because 100% of the *Statistics for Teachers* students were White and had English as their first language, it was not possible to enact practices (3) and (7).

Practices (4) and (10) were a source of troubled reflection for Professor Ellis and the researcher. While Professor Ellis did identify students’ current knowledge before instruction (only two of the students had any significant background in statistics), intense time pressure sometimes precluded a deep exploration of new concepts or a thorough consideration of every student’s thinking. In his post-semester interview, Professor Ellis said, “I felt like we just didn't have enough time for that to happen very often. Even when we had someone come up and show something, we talked about it a little bit, there was still more that needed to be said but we needed to move on to the next thing.” He commented on the fact that the American Statistical Association recommends three semesters of Statistics for pre-service teachers, while there is only one single-semester course offered. “I'm really starting to see why the ASA recommends three courses in stats, but the ones that they recommend I'm not sure... They're getting into advanced stuff and I think we just need more time on this basic stuff and the pedagogy.”

On one occasion, there was an in-class exercise where no student’s solution was correct, and Professor Ellis felt it would have taken too much time to analyze their developing thinking. When he offered to show his own solution, Melanie quipped, “Ours were that bad!” (Field notes, April 2, 2019). This remark was couched in humor, but indicated Melanie’s sense of frustration and defeat. In discussing this incident afterwards, Professor Ellis quoted the Wormeli (2011) article, “Redos and Retakes Done Right”:

> Anxious about this curriculum overload, we run our classes by alternating between admonishments: ‘Here’s a bunch of stuff you have to learn; now take a test. Here’s the next bunch of stuff you have to learn; now take the next test.’ When students fail to learn
content on this conveyor belt, we tell them, ‘We don’t have time to go back and teach it to you. Take the low grade and move on.’ This is no way to treat a child's future or conduct our profession. (p. 24)

Faced with the overwhelming number of mathematics and statistics standards that “must” be addressed in K-12 classrooms and in teacher preparation programs, it will take both conviction and courage to take the class time necessary to acknowledge all students’ comments, responses, questions, and contributions, as suggested by Voigt (2017) and cut out “required” material as necessary, as suggested by Marzano & Kendall (1998; see also Florian, 1999).

**Use of the Dynamic Data Visualization**

One of the early lessons in the *Statistics for Teachers* curriculum features a dynamic data visualization featured in the *New York Times* article, “Extensive Data shows Punishing Reach of Racism for Black Boys” (Badger et al., 2018a). As mentioned in the Results section, this lesson was specifically referenced in Melanie’s mid-semester interview about her developing views on educational equity, as well as on some of the course exit surveys that asked which lessons from the *Statistics for Teachers* materials were most valuable (S. Casey, personal communication, May 16, 2019).

One general concern was advanced by the Equity and Social Justice Working Group (a committee within the larger organization that sponsors the *Statistics for Teachers* writing team) after reviewing some of the equity-focused lessons in the *Statistics for Teachers* curriculum.

We predict that many of your lessons (that we saw or that may come in future lessons) will provoke observations and hypotheses about a “gap” between different segments of the population. Consider designing for a critical discussion on gap-gazing. Specifically,
how focusing on gaps between groups reify “gaps” that are the product of a system, not of the person. (B. Lawler & T. Weiland, personal communication, November 21, 2018)

Reflecting on this concern, as well as on the enactment of this particular lesson, I suggest a three-component modification of the lesson. First, the lesson could be made more exploratory, in accordance with feedback that the writing team received during a working conference in Spring 2018. Rather than simply showing the first animation in the article, pre-service teachers might be invited to play with the interactive version of the data visualization first (Badger, Miller, Pearce, & Quealy, 2018b). They could practice forming sentences about their own mobility animations: for example, “I found that both White boys and White girls growing up in middle-class homes had more upward class mobility than downward class mobility.”

Next, the instructor could show the visualization for White and Black boys growing up in poor homes. One potentially surprising thing about this particular configuration is that about the same percentage in both of those groups grew up to be poor. This might productively complicate the mainstream image of the urban Black ghetto as a place of particular degradation and despair. Furthermore, the data indicates that only about 29% of the boys in both groups remained poor – more than would be expected if education were truly the Great Equalizer, yet not as many as the stereotypes about poor families might lead us to expect.

Finally, the discussion about possible causes for the trends in the data might be leveraged in the direction of Lawler & Weiland’s (2018) vision for a critical examination of gap-gazing. Every beginning Statistics student learns that correlation does not imply causation, but even guessing about possible causes for differences in social class mobility could uncover a distinction between causes originating within the group (such as a “culture of poverty”) and causes related to external, systemic factors pressing in on that group. Students’ proposed causes
might be organized on a T-chart like the example below, with question marks on their initial intuitive guesses:

Figure 9: Discussion Tool for Data Visualization Lesson

<table>
<thead>
<tr>
<th>Internal to Group</th>
<th>External to Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Different value placed on education?</td>
<td>• Racial or gender prejudice in hiring?</td>
</tr>
<tr>
<td>• Different expectations of children?</td>
<td>• Unfair pricing of products (e.g. car insurance)</td>
</tr>
<tr>
<td>• Etc.</td>
<td>• Unfair school funding</td>
</tr>
<tr>
<td></td>
<td>• Large class sizes in school</td>
</tr>
<tr>
<td></td>
<td>• Race-based academic tracking</td>
</tr>
<tr>
<td></td>
<td>• Low teacher expectations due to stereotypes</td>
</tr>
<tr>
<td></td>
<td>• Etc.</td>
</tr>
</tbody>
</table>

There are several data explorations in the *Statistics for Teachers* course that identify systemic causes for these inequities in social mobility; each time this happens in the course, students could be asked to turn back to this T-chart and add to the list.

**New Content Addressing Stereotypes**

One modification of the *Statistics for Teachers* course is already underway. While the current study was being conducted, the *Statistics for Teachers* writing team had growing concerns over the ubiquity of stereotypes about families in poverty and families of color that were accepted without question by the pre-service teachers in our class. The pre-semester interviews had alerted us to this, and the mid-semester survey confirmed it. At that point, two of the *Statistics for Teachers* lessons had yet to be written (we had decided in advance to leave these lessons out during our first piloting phase). The Statistics content of these two lessons lent itself to an exploration of the results of some kind of questionnaire, especially if these results could be compared to a “null” situation where questionnaire respondents were randomly guessing.
We created a questionnaire that we hoped would expose some of the commonly-held misconceptions about families in poverty and families of color (included here, with correct answers, as Appendix B). The answer key for the questionnaire was drawn from the *Parent and Family Involvement in Education Survey* (McQuiggan & Megra, 2017) and the *General Social Survey* (T. Smith et al., 2018). We administered the questionnaire to 154 pre-service teachers and scored each questionnaire on a scale from zero to six (indicating the number of questions answered correctly). We found that the average score was 1.1, meaning that respondents answered, on average, about one question out of six correctly. If respondents had been merely ignorant of the facts and had been randomly guessing, the average score should have been three out of six; thus, it was clear that the responses were based on firmly held stereotypes rather than simple ignorance.

We have been able to build a Statistics lesson around these results. Pre-service teachers will take the questionnaire themselves and will then be shown the answer key. They will learn to do a formula-based hypothesis test on the set of 154 responses and will interpret the results in the context of societal stereotypes. They will then be presented with the portion of Troy’s interview that is included in the Results section of this paper and will be asked to analyze his mentor teacher’s comments in light of their findings. We are hopeful that this lesson will have an impact on the pre-service teachers’ answers to the survey question, “Generalizing from your knowledge and experience, how much do the following types of families value their children's education?” and will enable them to begin to critically analyze the stereotypes that may be present in their future schools.
Use of the Equity Survey

Feelings about discussing equity. As described in the Results section, the survey itself can be used as a tool for fostering courageous conversations about equity. It appears that debriefing the prompts, “When discussing equity issues, I worry that I will say the wrong thing and offend someone,” and, “When discussing equity issues, others are likely to do or say things that hurt or anger me” was an effective way of alleviating some of the initial anxiety surrounding these conversations in the Statistics for Teachers class. However, the survey might be leveraged even more effectively if it included a question about how students would prefer their classmates to refer to their identity groups. Recall the write-in comment, “I always worry about offending others because I don’t know the right terms to use when discusses things like culture, gender, and sexuality. Maybe we could discuss what everyone is comfortable calling different groups?” This would be a natural addition to the survey, and might be a further help to classroom conversations.

A tool for reflection. This study found evidence that the equity survey itself served as a tool for reflection on the meaning of educational equity and the structural barriers present for many marginalized groups. This was true for both the pre-semester and mid-semester surveys. While one respondent was answering the prompt on the mid-semester survey, “Generalizing from your knowledge and experience, how much do the following types of families value their children's education?” she began to question the stereotypes she had initially accepted:

When I was first doing this [question] I had varied checks and then I'm like, no I can't say that. That's not fair at all. … I had that like, we always hear that stereotype of Asian students like they really value their education and then we've been told that like African American not as much. Like it's just, but that's not true. (March 4, 2019)
The survey is currently written into the *Statistics for Teachers* course only at the beginning of the semester. However, it might be useful for pre-service teachers to complete the survey again, late in the semester, as the participants did for this study.

**Debriefing the “meaning of equity” question.** As explored in the Discussion section of this paper, the prompt, “Which most closely describes the meaning that equity in education has for you?” could be debriefed more productively. Rather than asking the pre-service teachers to simply explain their choices, they might be asked to categorize the choices under the three broader banners proposed by Makar (2004). Then, they could suggest present-day measures that would align with these categories. Finally, they could problematize those measures by asking what might be the consequences of using each measure exclusively. For example, using standardized test scores as the measure of equality of outcomes can result in teaching to the test for groups who are not performing well, resulting in lower-quality teaching for those groups. Additionally, the content of these tests is chosen by a few, non-elected, for-profit testing companies, and so may be considered problematic when it effectively dictates to a public institution.

An exercise like this would also serve pre-service teachers’ knowledge of Statistics, by putting quantitative measures in perspective as only one way of studying a phenomenon – one that comes with advantages and disadvantages. Below is an example of a two-dimensional chart combining Makar’s (2004) and Lister’s (2004) ideas with the survey response choices.
Figure 10: In-Class Organizer for Debriefing the “Meaning of Equity” Prompt

<table>
<thead>
<tr>
<th>Relevant survey response(s)</th>
<th>Category</th>
<th>Possible measures</th>
<th>Potential problems with these measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equality of inputs</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2)</td>
<td>2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3)</td>
<td>3)</td>
</tr>
<tr>
<td></td>
<td>Equality of outcomes</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2)</td>
<td>2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3)</td>
<td>3)</td>
</tr>
<tr>
<td></td>
<td>Fairness</td>
<td>1)</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2)</td>
<td>2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3)</td>
<td>3)</td>
</tr>
</tbody>
</table>

If the survey were given again, late in the semester, the late-semester prompt might be left open-ended, as follows:
Here are some ways in which educational equity has been defined during various historical movements:

- Equity is the same treatment for everyone so that all students have an equal chance to meet the same standards and an equal opportunity to master those standards.
- Equity is investing in students most at-risk, those whose success or failure in life depends on their school experience.
- Equity compensates for social injustice to specific groups of students who have not received fair treatment or a fair share of the resources by giving preference, when all else is equal, to underrepresented groups.
- Equity involves a safety net for individual differences (backup programs, differentiated curricula, and other resources) so that when one program does not work for a particular student, other options are available.
- Equity involves maximum return on investment: a concentration of scarce resources on those students who are most likely to succeed.

In the box below, please describe (in as much detail as you can) the meaning that equity in education has for you.

**Discussing Race**

In our cultural moment – perhaps among pre-service teachers especially – there are particular taboos around discussing race. In light of this, it could be very helpful to clarify two ideas that seem to be in opposition: (1) the idea that race is actually a social construct rather than something “real” in the sense of being objectively delineated, well defined, or universally recognized, and (2) the idea that people do have racialized identities which come from real experiences in their lives. In the latter sense, to deny the existence of race is to dismiss the suffering and injustice that people of color have experienced for hundreds of years in America. This is a subtle distinction, but one that is well explained by Tatum (1997) in her book, *Why Are All the Black Kids Sitting Together in the Cafeteria?* Tatum is strong in her conviction that race must be discussed in order to make any headway in eliminating the injustices that exist in our society. In particular, the section called “A Word About Language” (Tatum, 1997, pp. 15-17) could be very helpful to students who hesitate to say words such as “Black” and “African
American.” Spending a small amount of time reading what a Black woman has to say about this could have a large payoff – not only for class discussions, but also in the pre-service teachers’ racial identity development and, consequently, their ability to have authentic relationships with future students and parents with other racial identities.

**Questions for Further Research**

It would be very interesting to conduct the surveys again once the MODULE(S²) course and the survey instrument have been revised. For example, pre-post responses to the prompt, “Generalizing from your knowledge and experience, how much do the following types of families value their children's education?” could then be compared. Furthermore, the results presented in this study have been limited in their scope, since data was collected from a small sample of students in only one university. Ideally, the study should be repeated on a larger scale, in varied settings.

In future iterations of the study we might ask the initial research questions again: How do pre-service teachers initially conceptualize educational equity when they enter a teacher preparation program? Where do they place the responsibility for a child’s educational success: on individual, cultural, or structural factors? How can these perspectives shift, especially in the areas of racial equity and social justice, through exploring equity-related data in a course on *Statistics for Teachers*? Based on the results of this study, we might also add another question: What level of efficacy do pre-service teachers feel for redressing inequities, both in their classrooms and in the communities where they teach?

We might also ask these questions about other re-designed teacher education courses, in addition to the particular ones studied here. For example, a Practicum class could foster critical analysis of the ways school cultures do or do not reinforce stereotypes about families in poverty
and families of color; a Methods class could address equitable teaching practices more explicitly, as well as providing practice in lesson planning around K-12 students’ social justice concerns. An over-arching question, drawn from Westheimer (2015) might be, “What kind of citizenship is being fostered by our teacher preparation programs?”

**Conclusion**

Equity literacy goals can be addressed, either implicitly or explicitly, through a wide variety of teacher education courses. Modeling equitable teaching practices when instructing these courses is a strong beginning. These practices include setting classroom discussion norms, using students’ names, attending to grouping practices, and ensuring that all student voices are heard. Building on this foundation, instructors can use the tools of a discipline to examine specific educational equity topics. Social Foundations instructors might use history, sociological theory, and other humanistic disciplinary tools to critically examine the ways in which various groups are being marginalized in the present educational system. In the *Schools for a Diverse and Democratic Society* course, the results of this study showed a significant shift from individualistic to structural thinking about why some students succeed in our educational system while others do not.

Statistics instructors can make an equally important contribution using the tools and perspectives of their discipline. This study highlighted some of the contributions of the MODULE(S²) *Statistics for Teachers* course. First, the pre-service teachers’ initially high level of anxiety about participating in equity-related conversations decreased from pre-to mid-semester. This is an important change, since teachers must be prepared to engage in conversations that address inequitable learning experiences. Second, there was an increase in pre-service teachers’ thoughtful awareness of race. When teachers take a colorblind approach
that refuses to notice the race of their students, this leaves teachers’ actual biases free from interrogation; hence, the well-documented and widespread low expectations of Latinx and Black students (Gershenson et al., 2016; Papageorge et al., 2018). The pre-service teachers’ increased cognizance of race is an important step toward questioning their own assessments of their students’ abilities. In addition, it will equip them to engage in advocacy roles in their classrooms and schools. Finally, the pre-service teachers had an increased sense of teachers’ importance to students’ educational success. This points toward the benefits of exposing pre-service teachers to critical pedagogy in various content areas. Subject area courses are uniquely suited to address the specifics of how teachers can equip students for self-advocacy using the tools of their discipline.

All of these changes contributed to the accomplishment of teacher preparation standards published by the Association of Mathematics Teacher Educators (2017, Standards C.4.3, C.4.4, and C.4.5) and to the vision of participatory and justice-oriented citizenship outlined by Westheimer (2015). When engaging with curricular content in these powerful and courageous ways, adding opportunities for pre-service teachers to self-reflect at the beginning and end of each course helps them to consolidate their gains. The survey used in this study provided one such opportunity, as well as contributing to productive self-assessment for the MODULE(S^2) Statistics for Teachers writing team.
Discriminating Equity Issues (Followup)

Which most closely describes the meaning that equity in education has for you? If none of these descriptions come close, please describe what educational equity means to you in the field that says 'Other.'

A. Equity is the same treatment for everyone so that all students have an equal chance to meet the same standards and an equal opportunity to master those standards.

B. Equity is investing in students most at-risk, those whose success or failure in life depends on their school experience.

C. Equity compensates for social injustice to specific groups of students who have not received fair treatment or a fair share of the resources by giving preference, when all else is equal, to underrepresented groups.

D. Equity involves a safety net for individual differences (backup programs, differentiated curricula, and other resources) so that when one program does not work for a particular student, other options are available.

E. Equity involves maximum return on investment; a concentration of science resources on those students who are most likely to succeed.

Other:

Which factors are most responsible for ensuring children's educational success in the U.S.? (select your top 4, in order of importance.)

Please indicate how much you agree or disagree with the following statements.

Some cultural or socioeconomic groups value education more highly than others.

Strongly disagree

Strongly agree

I am comfortable discussing educational equity issues involving race, gender, disability status, and poverty, in my college classes.

Strongly disagree

Strongly agree

When discussing equity issues I worry that I will say the wrong thing and offend someone.

Strongly disagree

Strongly agree

When discussing equity issues, others are likely to do or say things that hurt or anger me.

Strongly disagree

Strongly agree

If you agreed with the above statement, please describe any specific words or behaviors that you would like others in this class to avoid.

Your answer

List anything that the instructor or your fellow students can do to support your engagement with these conversations.

Your answer

When I am asked to identify my race, socioeconomic status, gender, or disability status, the possibility of being "put in a box" bothers me.

Strongly disagree

Strongly agree

Our current educational system is unfair to students with disabilities.

Strongly disagree

Strongly agree

Our current educational system is unfair to economically disadvantaged students.

Strongly disagree

Strongly agree

Our current educational system is unfair to students learning English as a second language.

Strongly disagree

Strongly agree

Our current educational system is unfair to students in racially segregated school districts.

Strongly disagree

Strongly agree
Appendix B: In-Progress Course Material (Questionnaire)

Questionnaire: Families and Education

1. According to data from the 2016 federal Parent and Family Involvement in Education Survey, which families were more likely to expect their children to earn a graduate or professional degree?

Circle one:  Only one of two parents/guardians speaks English  Both parents/guardians speak English (or single guardian who speaks English)

56% of families with only one of two guardians speaking English vs. 37% of English speaking families

2. According to the same survey, which families were more likely to always have an adult check that children’s homework was completed?

Circle one:  Families not in poverty  Families in poverty

72% of poor families vs. 65% of non-poor families

3. On the 2016 General Social Survey, respondents were questioned about their level of interest in local school issues: “Are you very interested, moderately interested, or not at all interested?” Which group had the higher percentage of respondents say, “very interested”?

a. Circle one:  Asian  African American

63% of African American respondents vs. 40% of Asian respondents

b. Circle one:  Family income of $25K - $50K  Family income of $75K - $130K

48% of families with $25K-$50K income vs. 40% of families with $75K - $130K income

4. Respondents were also questioned about their level of confidence in the people running educational institutions in this country: “Would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?” Which group had the higher percentage say, “a great deal”?

a. Circle one:  Hispanic  White

36% of Hispanic respondents vs. 22% of White respondents

b. Circle one:  Family income of $0 - $25K  Family income of $75K - $130K

32% of families with $0-$25K income vs. 20% of families with $75K - $130K income
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