Evaluating an Adaptive Equity-Oriented Pedagogy: A Study of its Impacts in Higher Education

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Abstract

This study examines whether and how an adaptive equity-oriented pedagogy can address diverse college students' needs and preferred modes of learning. Using a mixed-methods approach, we evaluated this pedagogical intervention that synthesizes democratic, assessment-driven, strengths-based, multimodal, and game-based instructional strategies. This study compared two course sections with identical topics and assessments using different pedagogical approaches. In the control condition (n=59), instructors did not adjust their lectures, dialogues, and activities based on data of their students' learning needs. Meanwhile, the course with the adaptive, equity-oriented pedagogy (i.e., the treatment group, $n = 54$) had the same instructors who adjusted their teaching practices each week based on data related to their students' learning needs.

Researchers evaluated this pedagogy's impact on student learning by analyzing anonymous course-feedback forms, surveys, interviews, observation notes, final project assessments, and weekly pre- and post-assessments. After instructors in the treatment condition adjusted instruction based on weekly post-assessments and anonymous student-feedback forms, the researchers observed increased levels of student engagement, participation, collaboration, sense of community, and performance on post-assessments. Researchers found statistically significant differences on final assessment scores in favor of the equity-oriented pedagogy ($p<.0001$). These findings suggest that the equity-oriented pedagogy helped reduce barriers to equity and access since students surpassed rigorous course objectives, regardless of background (e.g., gender, immigration status, sexual orientation, race/ ethnicity, household income, disability). Despite the rigorous nature of the class, students reported positive psychosocial outcomes (e.g., motivation, self-efficacy), and noted how specific teaching practices were continuously modified to enhance their learning experiences. Based on the data, students expressed a growth mindset and reported reduced stereotype threat.

Keywords: Equity, assessment, pedagogy, academic achievement.

Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid. – Albert Einstein

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Einstein's statement underscores the absurdity of a key tenet of the modern education system: that a one-size-fits-all model is an accurate and appropriate way to evaluate student performance. Today, Einstein's insight has become increasingly relevant. In many cases, the current education system and its instructors have implemented curricula and assessments that serve some groups of learners, placing other students who learn differently at a disadvantage (Tomlinson et al., 2003). Consequently, traditional learning environments can be less conducive to optimal student learning because the mode of instruction may not fully accommodate the wide range of learning needs (Tomlinson et al., 2003).

Additionally, assessments and policies that do not meet diverse students' needs, preferred modes of learning, or primary discourse can pose challenges to students' success in school and college (Tomlinson et al., 2003; McCallum, 2013). Bettinger, Boatman, and Long (2013) add how "difficulties in the classroom can be discouraging and can complicate the academic, social, and financial adjustments to college. Ultimately, academic struggles may lead to lower self-esteem [and] greater frustration" (p. 94). These factors may lower students' potential to excel and increase their chances of dropping out of college (Bettinger et al., 2013). Consequently, these circumstances can limit students' employment opportunities and affect their socioeconomic status – all of which can sort and rank them in society (Bettinger et al., 2013; Azevedo & Workman, 2012). Hence, conducting research on creating an equitable and accessible space for student learning in college is critical; many students depend on curriculum and instruction to pursue professional aspirations and reach higher levels of education (Azevedo & Workman, 2012).

In response to these pressing issues, this study examines a human rights and community organizing course, which employs an equity-oriented pedagogy that hybridizes specific components of democratic, multimodal, assessment-driven, strengths-based, and game-based instructional strategies. We examine whether and how this equity-oriented pedagogy serves diverse students' needs and preferred modes of learning, in order to increase equity and accessibility in the classroom. Our study assesses whether this equity-oriented model provides more equitable opportunities and outcomes for academic achievement, where *all* students are provided conditions for learning that would enable them to 1) earn a 94% or higher in the course, and 2) meet or surpass the collaboratively defined learning objectives. We used 94% as a threshold because that metric equals an A-level grade, and therefore provides evidence that students mastered course material.

We define rigor in two ways through the collaboratively defined learning objectives. First, students applied course concepts through a community-organizing project that required them to address a novel problem and generate a solution that was later implemented in the community. Second, students demonstrated this knowledge by refining their projects and reflecting on their experience while employing multiple cognitive processes (e.g., defining, applying, comparing, contrasting, synthesizing, evaluating, and formulating concepts) (Davis, 2009; Anderson, Krathwohl, & Bloom, 2001). In addition to course expectations, this project experience added a focus to this class that advanced the development of these cognitive processes and asked students to expand the ways they demonstrated knowledge gained.

We compared two courses with the same subject material and measures using different pedagogical approaches. Like many college courses, one course's instructors (i.e., the comparison or control group) did not adjust their lectures, dialogues, and activities based on data of their students' learning needs. Meanwhile, the course with the adaptive, equity-oriented pedagogy (i.e., the treatment group) had the same instructors who adjusted their teaching practices based on data of their students' learning needs. With this comparison in mind, we examined the following research questions:

1. How do final assessment scores vary between the treatment and control groups?
   a. How, if at all, do these final assessment scores vary by student demographic characteristics (e.g., gender, disability, immigration status, etc.)?
2. How does the trend over time in gain scores (i.e., the difference between weekly post- and pre-tests on subject material) vary between the treatment and control groups?
3. How do the pedagogical impacts on stereotype threat vary between the treatment and control groups?
4. How do the pedagogical impacts on psychosocial outcomes (e.g., motivation, sense of self-efficacy, sense of community, etc.) vary between the treatment and control groups?
5. How can the adaptive, equity-oriented pedagogy be improved to better address students' learning on a weekly basis?
6. What were the students' perceptions and impressions of the courses and their learning experiences?
7. What recommendations would be useful for equity-oriented curriculum in the future?

The control group integrated active learning and mirrored higher education classrooms that do not continuously adjust teaching based on student data. These active learning strategies include evidence-based practices such as inquiry-based and case-based teaching used in many higher education settings. Because the numbers of historically underrepresented groups and first-generation students in higher education courses are increasing (Stevens & Kirst, 2015), this research is important and timely for practice. Therefore, we believe it is important to study practices that seek to improve equity and inclusion in the classroom for all students, especially for historically underrepresented students.

Literature Review

Educational Equity and the Factory Model

In the early 1900s, the factory-model system instituted grade levels where teachers focused on one set of students of the same academic proficiency; the theory posited that teachers could teach the same subjects, in the same way and at the same pace to all students (Delaney, 2000; Perea-Jimenez, 2008). The factory model was designed to prepare people to work on an assembly line; the dull and routine activities in schools mirrored factory work (Delaney, 2000). This model legitimated standardized curricula and high-

stakes testing movements, which institutionalized teacher-centered pedagogies that "ignore[d] the needs of all students" (Perea-Jimenez, 2008). Cooley (1999) argues that the factory model has become pervasive in universities, especially with the ways faculty teach and assess college students using one-size-fits-all pedagogical models (p. 72). Selwyn (2007) adds that the factory model's depersonalized nature shifts instruction away from a learner-centered orientation and can hinder learning opportunities in higher education. Moreover, Rudy Hirschheim (2005) states that a "more standardized, minimalist product targeted for a mass market" will "further 'box in' and 'dumb down' education, resulting in a system that does not support the endeavours of superior scholars and thinkers" (p. 101).

In response to the factory model's ramifications, multiple scholars have recognized the need to improve educational equity. For instance, Bourdieu (1973), Lareau (2003), and Delpit (1995) demonstrate how educational institutions and instructors often privilege the dominant, middle- and upper-class cultural capital in classrooms. These authors assert how a lack of access to the dominant cultural capital and a lack of clear expectations contribute to the challenges that low-income students and students of color face in learning.

Similarly, Gee (1996) states that students who are minorities and of low socioeconomic status often come from a primary discourse (i.e., the discourse that people learn in their household and local community), which does not match the dominant discourse (i.e., any discourse which leads to social goods and socioeconomic mobility) taught in schools and colleges. In these educational settings, students are expected to learn not only the course material but also how to think, feel, and behave in a new context. Furthermore, inequities can arise in the educational system since academic achievement is often difficult when a dominant discourse assumes a hegemonic cultural capital for academic success. This places many students from historically underrepresented backgrounds at a disadvantage, barring them from equitable access to academic achievement (Gee, 1996). To complicate Gee's notion of discourse in a sociological context, Allan Luke (1995) suggests that educators should not overvalue the dominant discourse, but understand students' various discourses, background knowledge, skills, and behaviors. To achieve this goal, Moll, Amanti, Neff, and Gonzalez (1992) propose that instructors can draw upon their students' funds of knowledge– i.e., students' background, skills, and aspirations– to maximize engagement, learning, and a sense of belonging within the classroom.

Critical and Democratic Pedagogy

To address these problems with educational equity, we must consider how Freire and Shor critique and reimagine teaching practices to accommodate students' multifaceted needs and experiences. Freire (1970) and Shor (1992) criticize the factory model's banking method, where the teacher treats students as empty vessels and fills them with knowledge. They offer the problem-posing model as an alternative to the banking method to increase equity and access in the classroom. This model asks students to become critically aware of their society and then, through dialogue and praxis, transform their society. Problem-posing involves three methods of instruction: posing a problem to the students in a dialogue; reflecting on their understanding of the problem; and incorporating literary

development exercises centered on cooperative learning (Shor, 1992). In this model, students are the subject – not the object – of the classroom. These authors would envision accessibility in that instructors should not be the gatekeeper of knowledge, but rather students should co-create knowledge and expand their critical consciousness *with* the instructor. Therefore, students would use dialogue to reverse or blur classroom hierarchies, allowing for a more equitable exchange of knowledge. What Freire calls critical consciousness or "conscientization" – where one gains a heightened awareness of their reality and how societal structures are reproduced – can then occur recursively when students act on this knowledge, reflect, redirect their thinking, modify their behaviors, and repeat this cycle. These skills facilitate democratic participation, since they empower students to teach each other and engage in their communities politically.

Creating an Optimal Learning Environment

Expanding the definitions of equity and accessibility, Knight and Pearl (2000) state that teachers should establish an optimal learning environment tailored to student needs, interests, engagement, and satisfaction within the classroom. These authors argue that Freire's (1970) and Shor's (1992) ideas do not necessarily provide equity and accessibility to all students. For example, a dialogical atmosphere in the classroom may not be optimal for all students since it tends to privilege those who are vocally active or who more easily retain information through auditory means. Therefore, Knight and Pearl (2000) suggest that the overemphasis on dialogical learning is not sufficient for overcoming oppression and promoting equity and access. Thus, dialogue and problem-posing can undermine equity when students do not possess the knowledge necessary to democratically participate in the classroom and in their communities.

Knight and Pearl (2000) would add that educational equity increases when students have a voice regarding classroom pedagogies. By having a voice, students can co-create with the instructors an optimal learning environment that addresses their needs, interests, funds of knowledge, and areas for improvement based on assessment (Knight and Pearl, 2000). Knight and Pearl (2000) would define this approach as democratic pedagogy since students have an active role in co-constructing their learning environment. These authors argue that this form of democratic education would increase inclusion since students can express what helps them learn best. Moreover, Knight and Pearl (2000) assert that democratic education needs to value multiple ways of learning and demonstrating knowledge, in order to avoid a model of education that privileges specific groups of learners.

Assessment-Driven and Strengths-Based Pedagogy

McCallum (2013) discusses how an assessment-driven instructional pedagogical model can help establish a more democratic and student-centered classroom that Knight and Pearl (2000) would espouse. In this model, teachers would use ongoing classroom data (e.g., student-assessment data, course-feedback forms/ evaluations, surveys, interviews, observation notes) to adjust instruction in order to better serve students' needs and preferred modes of learning. McCallum (2013) contends that such a process would be demo-

cratic and student-centered when instructors use classroom data and dialogue with students to co-construct an optimal learning environment.

Moreover, identifying a student's preferred modes of learning is important. A student's "preferred modes of learning" refers to the modes of learning (e.g., listening to a lecture, engaging in collaborative activities, learning through visuals, discussing information, etc.) and classroom conditions that have helped the student learn best in previous educational settings (McCallum, 2013; Tomlinson, 2003; Tomlinson et al., 2003). Therefore, ongoing assessments are needed to identify which modes of learning best engage their students in learning. This process of adjusting instruction is known as differentiated instruction (i.e., tailoring instruction to meet students' learning needs) (McCallum, 2013; Tomlinson, 2003; Tomlinson et al., 2003).

Freishtat (2016) builds upon this process by introducing a strengths-based pedagogy, where instructors draw on their strengths to optimize student learning. To achieve this goal, instructors would analyze assessment data and student feedback to identify and leverage their pedagogical strengths – teaching practices that engage students' funds of knowledge and improve their academic success.

Multimodality

Similarly, the New London Group (1996) and Stein (2004) would define equity and access as accommodating students' needs and preferred modes of learning. The New London Group (1996) and Stein (2004) define multimodality as an approach that appeals to both multiple modes of learning – visual, auditory, and kinesthetic – and multiple modes of communication – the visual, gestural, and the performative. Examples of multimodal instruction include a mix of simulations, drama, spoken word performances, dance, art, videos, music, and the use of technology. This pedagogy can facilitate students' comprehension of course material since they have many opportunities to learn, reinforce, and demonstrate their knowledge through multiple modes.

Game-Based Pedagogy

Introducing another way to increase equity, Nguyen and Phuong (2016) offer a game-based pedagogy that integrates game-like mechanics into the classroom. In Nguyen and Phuong's (2016) game-based model, students can redo tasks and assignments to improve their results, similar to reattempting a level in a video game. This process would provide more equitable opportunities and outcomes for academic achievement, since all students have multiple chances to learn and demonstrate their knowledge of course material.

O'Rourke, Haimovitz, Ballweber, Dweck, and Popović (2014) and Dockterman (2013) found that game-based learning can improve students' growth mindsets, where students can focus more on improvement and the learning process rather than the grade or outcome (Dweck, 2006). According to Dweck (2006), growth mindset is the notion that students can learn and improve their skills through effort and a strong work ethic (Dweck, 2006). Game-based learning can support a growth mindset since it offers opportunities

for students to attempt a task, assignment, assessment, and problem more than once. This process can help students learn and grow from mistakes or risks taken during their first attempt. A student's re-attempt for a higher score on an assessment may suggest that they have a sense of hope and/or confidence that they will excel on future attempts (i.e., a core component of expressing a growth mindset).

Furthermore, the process of developing a growth mindset among students is an effective method to reduce stereotype threat (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007). Steele and Aronson (1995) define stereotype threat as being at risk of confirming a negative stereotype about one's social group. In their study, Steele and Aronson (1995) demonstrated how African American students performed worse when their racial identity was made more salient before testing (Steele & Aronson, 1995).

Reducing stereotype threat can increase equity and access in the classroom; often times, many minority and marginalized students activate negative schemas of their identity, which can undermine their academic performance (Cohen & Steele, 2002; Cohen, Steele, & Ross, 1999; Davis, 2009; Steele, 1997). Hence, promoting a growth mindset combats stereotype threat by motivating students to perceive intelligence as a muscle that grows with effort, which is not determined by their background and identities (Aronson et al., 2002; Blackwell et al., 2007). By advancing a growth mindset, game-based learning can enhance positive psychosocial outcomes (e.g., motivation, sense of self-efficacy, and resilience), which can impact students' performance (Dockterman, 2013; O'Rourke et al., 2014).

Synthesizing Definitions of Equity

We would like to expand upon how the authors mentioned above have envisioned equity and accessibility. We define equity as creating an optimal learning environment that offers students opportunities to demonstrate their knowledge and improve their skills in various ways. This definition encompasses pedagogies that broaden students' critical consciousness by drawing upon their funds of knowledge and cultural capital to maximize their academic success. We consider Lareau's (2003) and Delpit's (1995) assertions that accessibility is linked to how clear the expectations are to excel in the class. Our definition of accessibility incorporates theories from the literature review by measuring how the modes of instruction help students process the main points of the class, apply course material to new contexts, construct original ideas and arguments, and understand their social role vis-à-vis their reality. We define equity of opportunity as instructional practices that challenge and enable students to excel while accounting for students' backgrounds and obstacles. Equity of outcome is realized when all students' – underserved and privileged – needs are addressed, enabling them to 1) earn a 94% or higher in the course, and 2) successfully fulfill or exceed the courses' collaboratively defined learning objectives.

Methods

Background on the Human Rights and Community-Organizing Course

In this community-organizing course, students learn how to use theories from a wide range of disciplines (e.g., Political Science, Business, Sociology, Psychology, Peace Studies) to analyze social justice issues and solutions. Students learn the current debates surrounding human rights law, human trafficking, immigration policies, LGBTQ+ rights, education policy, income inequality, and conflict resolution among others. Instructors ask students to employ different viewpoints and theories to analyze the root causes, institutions, and policies that perpetuate current problems. Students collaborate to build upon the strengths and limitations of proposed solutions to reimagine public policy and improve the prospects for social change.

Instructors also ask students to participate in community-organizing groups outside of class. Students had the choice of selecting one of the four weekly community-organizing groups: grassroots community activism, publications, event organizing, and video production. Students apply course concepts and reflections from hands-on work in their groups to implement and refine a semester-long community-organizing project.

Participants

For the treatment, our study's participants were 54 undergraduate students in a human rights and community-organizing course. Similarly, the control group was the same course taught at a different time with 59 students. All the students in both the treatment and control groups agreed to participate in the study. The same instructors taught both of the courses.

Students signed consent forms and were assured confidentiality of the results, as per the Institutional Review Board protocol. The students' ethnic and economic demographics were diverse; their household incomes ranged from $12,000-$450,000. Students' ages ranged from 18-43 years. By applying Fisher's exact test, we found that students' background characteristics in the equity-oriented classes (treatment) and non-adaptive classes (control) are comparable across the demographic variables shown in Table 1 below. We found no statistically significant differences across students' background characteristics. These samples of students are not representative of the population for other higher education institutions. We oversampled for historically underrepresented groups of students because we wanted to study whether and how the equity-oriented pedagogy could address the learning needs of these groups.

Description of Control Condition

For the control group, the same group of instructors agreed to participate. These instructors did not adjust instruction based on student learning data ($n = 59$). Aside from this factor, instructors did their best to teach in the same way as in the treatment group. However, instructors did not use student data and feedback, but their best intuition to inform

Table 1. Background characteristics of treatment and control groups.

Demographic Variable	Treatment (*n* = 54)	Control (*n* = 59)
Gender		
Female	33 (61%)	35 (59%)
Male	18 (33%)	18 (31%)
Non-Conforming	3 (6%)	6 (10%)
Sexual Orientation		
Heterosexual	49 (91%)	53 (90%)
Lesbian/ Gay	3 (1%)	3 (1%)
Bisexual	2 (.04%)	3 (1%)
Disability		
Yes	16 (30%)	19 (32%)
No	38 (70%)	43 (73%)
Immigration Status		
Immigrant	20 (37%)	21 (36%)
2nd gen. immigrant	12 (22%)	13 (22%)
Native/non-immigrant	22 (41%)	25 (42%)
Race/ Ethnicity		
Latinx or Spanish	9 (17%)	13 (22%)
White or European	13 (24%)	15 (25%)
Black/African American	1 (2%)	2 (3%)
Southeast Asian	5 (9%)	5 (8%)
East Asian	11 (20%)	12 (20%)
South Asian	11 (20%)	10 (17%)
Middle Eastern	1 (2%)	0 (0%)
Multiracial	3 (6%)	2 (3%)
Household Income		
$0-$59,999	8 (15%)	14 (24%)
$60,000-$99,999	14 (26%)	16 (27%)
$100,000-$139,999	15 (28%)	12 (20%)
$140,000+	17 (31%)	17 (29%)

Note. Data was self-reported by students at the beginning of the semester. Students' background characteristics were comparable; using Fisher's exact test, we found no statistically significant differences across students' background characteristics.

instruction. The treatment course was taught before the control class to mitigate the possibility that the instructors would have a well-rehearsed lesson when teaching the treatment course.

The key difference is that the instructors in the treatment used the student data and feedback to adjust instruction, whereas the same group of instructors in the control did not use data and feedback to improve instruction.

Description of Treatment: An Adaptive Equity-Oriented Pedagogy

The 54 students in the treatment experienced an adaptive equity-oriented pedagogy. Instructors used an equity-oriented pedagogy by hybridizing specific components of democratic, assessment-driven, strengths-based, multimodal, and game-based pedagogies. For this equity-oriented pedagogical model, instructors integrated a democratic pedagogy where students had the power to express how they learn best and exercised agency in co-constructing their educational environment and assessment models (Freire, 1970; Knight & Pearl, 2000). To encourage student voice, instructors asked students to reflect on their experiences as learners in order to democratically establish classroom guidelines and norms. With the goal of transforming the classroom into an inclusive community, instructors employed community-building activities where students empathized with each other's experiences, validated their peers, and had opportunities to understand each other's learning needs (Freire, 1970; Knight & Pearl, 2000). In addition, students had a voice in designing and self-evaluating their community-organizing project. This approach provided students with opportunities to select ways that enabled them to uniquely demonstrate their knowledge and skills.

To adjust instruction and better address students' learning needs each week, the instructors also incorporated an assessment-driven pedagogy to collect ungraded formative student-assessment data (i.e., weekly pre-tests and post-tests), survey data on student interests, and weekly anonymous course-feedback forms (McCallum, 2013). The pre-tests were administered at the beginning of each class meeting to assess how much students knew about a topic. The post-tests were administered at the end of each class meeting to gauge how much students learned. The surveys of student interests in the course material were administered at the beginning of class. Lastly, the anonymous course-feedback forms were provided at the end of each class meeting. The ongoing assessment data, surveys and anonymous course-feedback forms helped instructors identify and address students' learning needs (i.e., their strengths, interests, and areas for growth).

Each week, instructors used this data on students' learning needs to adjust the following teaching practices:

- modeling skills and strategies that students need to excel on the final
- including time for students to practice these skills and strategies in class
- providing low-stakes feedback to students and addressing misconceptions in class
- helping students incorporate feedback in future assignments or tasks that align with the rigor of the final.

Throughout this process, instructors applied Freishtat's (2016) strengths-based pedagogy, where they drew on their strengths as instructors to optimize student learning. First, instructors identified and analyzed their teaching practices that helped students learn based on anonymous weekly course feedback forms and weekly pre- and post-tests. Then, the instructors focused on leveraging their pedagogical strengths – teaching practices that engaged students' funds of knowledge and improved their academic achievement. The instructors adjusted instruction and met students' needs through multimodal instruction, which includes a synthesis of PowerPoint lectures, simulations, role-playing, dialogues, technology, music production, and art (The New London Group, 1996; Stein, 2004). This multimodal approach incorporated a universal design for learning framework since it offered students multiple means of engagement, representation, and action and expression (Hehir & Shifter, 2015; Meyer, Rose, & Gordon, 2014; Glass, Meyer, & Rose, 2013).

To increase opportunities for academic success, the instructors implemented game-based pedagogy by allowing students to redo graded assignments and assessments (Nguyen & Phuong, 2016). Students earned points for finishing specific tasks, similar to players of a video game (Dockterman, 2013; O'Rourke et al., 2014). For example, students gained points for attending class, taking notes, asking and answering questions, demonstrating their understanding of course concepts, and sharing their experiences or insights on course material. Instructors also sought to increase students' sense of community through game-based learning as students worked together as teams to score points, support each other, and achieve common goals. Instructors taught as a team and they designated an instructor who was not teaching that day to tally up points during class. Moreover, students had to collaboratively reach a certain number of points to pass each lesson (or level); if they reached a higher threshold of points, they did not need to complete an online assignment because they had already applied course material in original ways.

To reduce stereotype threat and foster a greater sense of inclusion, the instructors used this game-based pedagogy to validate and affirm students' academic skills, experiences, identities, and contributions to the classroom (Hurtado, Alvarez, Guillermo-Wann, Cuellar, & Arellano, 2012; Cohen, Garcia, Apfel, & Master, 2006). By framing the course as a game, this pedagogy encourages students to self-affirm their potential, validate their peers, and support each other as they progress through the learning odyssey together. By applying these strategies to increase equity, the instructors strove to provide an engaging, non-punitive, and safe space that challenged students to practice new and multiple ways of demonstrating knowledge.

Methodology: Design-Based Development Action Research

For our methodology, we carried out a form of design-based development teacher action research – a methodology whereby teachers collaborate to continuously design, develop, evaluate, and modify curricula through classroom research (Plomp, 2010; Pine, 2009). We applied this methodology because we work with instructors and students who hold diverse perspectives on effective teaching practices – e.g., lecture, dialogue, simulations, digital learning, and active learning. We discussed these interpretations with instructors and students, which reduced the bias of interpreting data since we incorporated instructor

and student perspectives in the findings and discussions, thereby not skewing the results in favor of a single viewpoint. Through this process, we triangulated the data to study the research question from at least three viewpoints (instructors, students, and researchers) and thematically coded datasets (e.g., weekly pre- and post-assessments, detailed notes on classroom observations, surveys, final project assessments, interviews, and weekly anonymous course-feedback forms/ evaluations).

In the control group, the instructors and researchers integrated the same measures, but did not adjust instruction. Researchers observed every single class session. This was done to determine if the 1) treatment course applied equity-oriented pedagogy and 2) if the control course did not adjust instruction based on data. This process was applied to ensure fidelity of implementation and to reduce threats to validity.

Procedure and Measures

In order to examine how the control and treatment impacted diverse students' achievement and psychosocial variables over time, we gathered data from both qualitative and quantitative data sources from both samples. Table 2 presents our variables of interest and the related data from students and teachers.

Table 2. Matrix of Variables and Data Sources.

Type of Information	Data from Students	Data from Instructors
Demographic and Background Information	-Student background questionnaire	-Instructor background questionnaire
Academic Achievement	-Weekly gain scores (weekly post-test administered at the end of each class - weekly pre-test administered at the beginning of each class) -Final project assessment scores -Weekly course feedback forms/ evaluations at the end of each class meeting with written responses	
Psychosocial Variables (e.g., motivation, sense of self-efficacy, sense of community)	-Individual structured interviews -Likert scale surveys with written responses -Observation notes of classroom instruction from researchers	-Interviews and ratings about each student -Observation notes from instructors
Stereotype Threat	-Individual interviews of students -Likert scale surveys with written responses	-Interviews and ratings about students -Observation notes

Background surveys. Researchers administered surveys to ask students for background data about themselves, their family, community, and education. The goal was to identify the resources and obstacles that students bring to the classroom, which may impact their academic achievement. Some of these responses are provided in Table 1.

Course feedback and surveys. Online or in-class surveys were used to gauge student perspectives that may not have been explicit from mere observations and assessments. The weekly anonymous course-feedback forms included numeric and short answers so that we could assess how the control and treatments' pedagogies impacted students' learning experiences. The survey questions were anonymous and did not affect grades so students could provide honest responses. An example of one question was, "On a scale of 1-7, how useful was the lecture in helping you master today's learning objectives? Please explain why you selected this number." The surveys were limited to six questions so students could write substantive and reflective responses. In addition, surveys also helped us identify students' needs and preferred modes of learning. Instructors and researchers used this data to develop instructional plans and course goals to which students contributed or modified. These methods helped us measure whether or not the pedagogies addressed student needs and increased equity and access in the courses.

In both the treatment and control conditions, researchers also interviewed students about how the pedagogies affected their classroom experience; we administered follow-up anonymous questionnaires every week, asking about students' evaluations of the pedagogies. We also administered surveys and interviews asking students about fixed – i.e., intelligence is static – and growth mindsets – i.e., the belief that one's intelligence and skills can grow (Dweck, 2006). Researchers also surveyed students about stereotype threat and psychosocial outcomes, such as self-efficacy. The instructors were not present when anonymous course-feedback forms and interviews were conducted.

Pre- and post-tests. On the pre-test, instructors asked 10 questions focused on the content of the intended lesson. The same questions were asked at the end of class on the post-test. For the treatment, the assessment data from these tests provided instructors with student scores so instructors could adjust instruction based on students' level of understanding. The adjustments occurred in the treatment, but not in the control condition.

While applying the design-based methodology, we took notes on changes in student engagement. We administered weekly pre-tests and post-tests – formulated in conjunction with Dr. Richard McCallum (2013), Elizabeth Keithley, and Paige Keeley's (2008) *Science formative assessment* text – during every class meeting to measure if students fulfilled the need to know more about the topic than they did before the class. The pre-tests asked students to demonstrate their background knowledge on the class topic. When completing short answer responses on their pre-tests, students could map their ideas with detailed descriptions, write sentences, or bullet-point key concepts at the start of class. The post-tests measured students' newly learned knowledge. These post-tests also helped us determine whether instruction was accessible in that students could understand, define, apply, and relate each class' main points to their background knowledge, opinions, other course concepts, and their final project. Each week's pre- and post-test assessment ques-

tions were the same for all participants. We used a repeated measures approach and calculated students' weekly gain scores with the following equation: Week X Gain Score = Week X Posttest - Week X Pretest Scores.

Students applied this knowledge to engage in and critically analyze a final community-organizing project. The goal of this semester-long project was to allow students to connect their existing cultural capital and funds of knowledge to the new classroom material, thereby maximizing engagement while developing and expanding their academic skills and critical consciousness.

The instructors did not grade any assessments. All assessments were randomized and were blinded by student name and group (i.e., treatment and control). Therefore, researchers did not know whose assessments they were grading and to which group (i.e., treatment and control) these assessments belonged. In addition, these graders would not be able to look at an assessment and know whether it was a pre-assessment or a post-assessment. For both conditions, graders also used the same rubric, which were based on the course's learning objectives. We applied these procedures to reduce threats to validity and mitigate any personal biases that may impact student assessment.

Researchers and students rated how much they thought instructors changed their practices in both the treatment and control conditions. Researchers and students had similar averages about change and adaptation of teaching in the control and treatment conditions.

Data Analysis

Qualitative data analysis. We used Saldaña's (2009) and Bogdan and Biklen's (1998) methods of coding, categorizing, and identifying patterns in the data. We engaged in an inductive coding process where we identified themes and assigned a thematic code to each theme. We then created larger, overarching thematic codes based on patterns, which became the focus of our findings (Causton-Theoharis, Theoharis, Orsati, & Cosier, 2011). To improve inter-rater reliability, we inserted these codes into a code book where we established common definitions of engagement and achievement with examples to guide our analysis. For example, we defined engagement as attending class, taking notes, asking and answering questions, demonstrating understanding of course concepts, and sharing their experiences or insights on course material. Our coding schemes helped determine if there was a frequency of certain phenomena or changes in student engagement and achievement.

We also recorded the interviews and coded for indicators of a strong growth mindset. We coded the responses to examine if students respond with language representing a fixed or growth mindset (Dweck, 2006).

These coding schemes helped us determine if there was a frequency of certain phenomena or changes in student behavior. From this data, we sought to elicit the ways in which the equity-oriented pedagogy addressed or did not serve student needs, and how its success or failure affected equity and access in the classroom. The following results section

functions as a meta-criticism as it assesses the effectiveness of the instructors' self-assessing strategies.

Quantitative data analysis. In the beginning, we compared background characteristics of the students in the treatment and control groups. The groups were very similar; we found no statistically significant differences at the 0.05 alpha level using Fisher's exact test. We analyzed the gain scores and final assessment data by comparing the trends between the treatment and control groups. We did this for each weekly class session as well as for the final assessment scores.

We employed non-parametric measures (e.g., the two-sample Wilcoxon rank-sum test and Spearman's correlation) for these analyses after determining that the distribution of final assessment scores was not approximately normal. We used the two-sample Wilcoxon rank-sum test (i.e., the Mann-Whitney test) to check for statistical significance at the 0.05 alpha level. We also applied Spearman's correlation to estimate correlations between the final scores and the treatment group. This analysis of the quantitative data allowed us to compare the students' final assessment scores in the adaptive equity-oriented classroom (i.e., the treatment condition) and the non-adaptive classroom (i.e., the control condition).

Results

Comparing Final Assessment Scores and Gain Scores

We compared final scores between the treatment and control conditions. We found statistically significant differences on the final assessment scores in favor of students who were in the classroom that implemented the adaptive equity-oriented pedagogy (i.e., treatment) ($p<.0001$). There is a strong correlation between the final score and the group to which students were assigned ($r=0.78$, $p<.0001$). Table 3 presents the correlation coefficients of final assessment scores with the treatment, by gender, disability, and immigration status. The average final score for the treatment was around 97 points ($SD=1.98$) and the average final score for the control was approximately 82 points ($SD=8.28$). 100% of the students in the treatment scored above 90 points, whereas 22% of the students in the control scored above 90 points.

When comparing weekly gain scores, we noticed a consistent pattern where the treatment group outperformed the control group. Figure 1 below illustrates that the average gain score differences are large. Both groups showed gains from the pre- to post-test. In the beginning, students in the treatment had an average gain score that started in the low 40s and eventually increased to the low 60s. By contrast, the students in the control group had an average gain score of about 30 points every week with a noticeable increase to 43 points in the final week. Similar findings also held when controlling for multiple intersectional identities (e.g., gender, immigration status, and disability). Please see Appendix A for line graphs that display these findings.

Table 3. Correlation coefficients of final assessment scores with the treatment condition, by gender, disability, and immigration status.

Demographic Subgroup	Correlation Coefficient
	r
All students	.78
Gender	
Female	.75
Male	.84
Non-Conforming	.74
Disability	
Yes	.86
No	.73
Immigration Status	
Immigrant	.79
2nd gen. immigrant	.87
Native/ non-immigrant	.73

Note. $p < .0001$ for all coefficients except for gender non-conforming where $p < .05$.
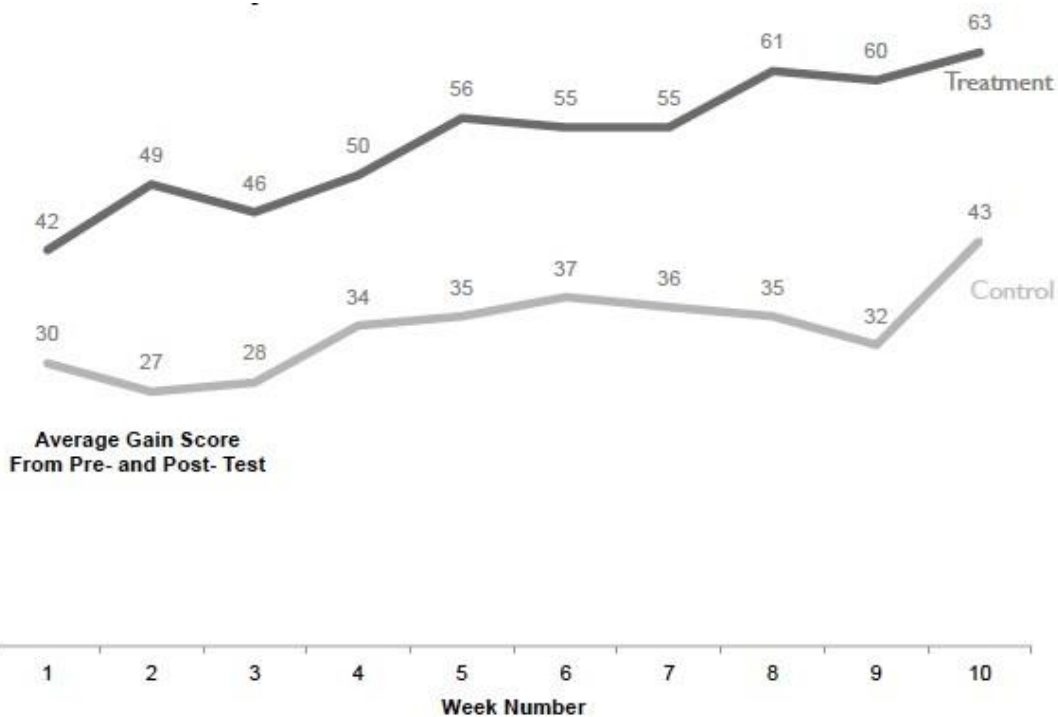
Figure 1. Students' average gain scores by group and by week of the course.

In Figure 2 below, we provide a scatter plot of the final assessment scores that were collected from the treatment and control groups. Although the differences in average gain scores varied between each of the groups for certain demographic variables, it appears that students in the treatment group were more successful at applying course concepts on the final assessment.
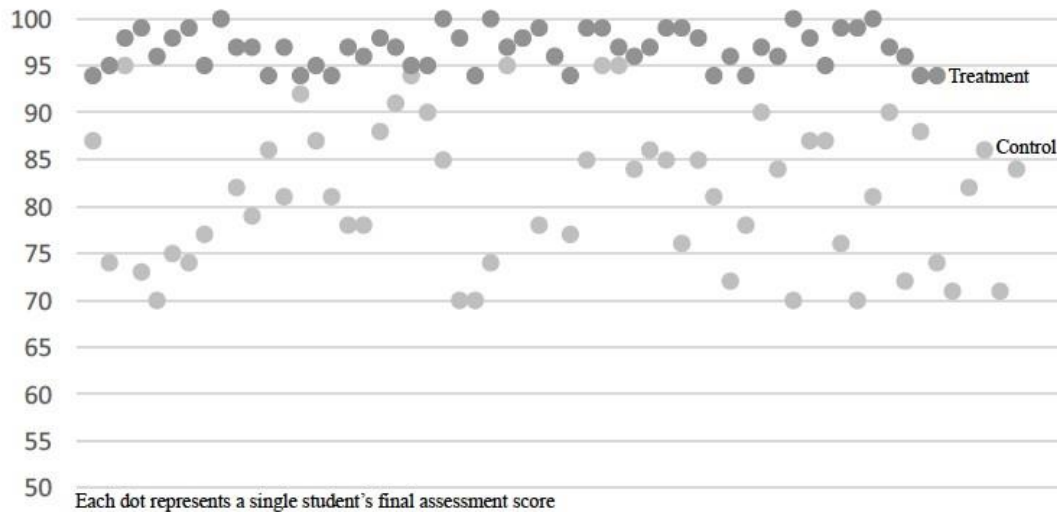
Figure 2. Students' final assessment scores.

Pre-test and Feedback Ratings

In the control condition, the same instructors did not adjust their instruction based on student data. Researchers took observation notes of the teaching practices in each condition to ensure that instructors in the control group did not adjust instruction like they did in the treatment group. According to researchers' observations notes, the control condition employed exemplary teaching practices such as active learning, problem-posing, case-based teaching, and inquiry-based learning. Researchers also surveyed and interviewed students about how much the instructors changed their teaching. The students in the control group noted and researchers agreed that the instructors' teaching in the control group remained consistent from the beginning to the end of the course. Moreover, the students in the treatment agreed with the researchers that the same instructors in the treatment condition adjusted their instruction substantially based on student learning data.

For eight of the ten weeks, there were no statistically significant differences on the weekly pre-test scores. The only exception was in the first two weeks, when the students in the control group had scores that were higher than the treatment ($p<.05$). In these first two weeks, the researchers observed higher levels of student participation in the control classroom than in the treatment classroom. At the beginning of the class, researchers interviewed students in the control condition and the students stated their background knowledge facilitated their participation in class.

Moreover, the control group's course-feedback form ratings were averaging around a 5.6 out of 7 at the beginning of the semester. In comparison to other introductory courses within the same field, the variability within course feedback was comparable with regards to the variety of opinions: There were students who stated that the teaching practices addressed their learning needs, some students were indifferent, and other students felt that the teaching practices did not address their needs. For instance, many students remarked how there were few foundational concepts that they were unsure of. Another student felt that parts of the class moved much too quickly and the peer-to-peer learning did not help with learning, since sometimes peers were confused on course concepts. By contrast, a different student mentioned that "the course moved at a good pace for me. I was always engaged because there was little lecture and a lot of dialogue." At the end of the semester, the anonymous course-feedback rating was about a 5.8 out of 7 in the control condition.

Equity and Access

In the treatment condition, the data collected prior to the implementation of student feedback reveals ways in which initial classroom instruction was inequitable and inaccessible. For the first three weeks of class, the instructors characterized the students as reserved and unengaged. A total of 6 out of 54 students spoke during the first two class meetings. At this time, class ratings – from a scale of 1 to 7 on the usefulness of lectures, discussions, and activities for learning about the day's topic – were around 5.56 as an average and 6 as a mode and median. Students agreed the instructors were well-organized, but the class was not meeting their preferences. Two-thirds of students stated that having the problem-posing portion of democratic education at the beginning of the class was inequitable, because it privileged the verbally confident students and those who already had a significant amount of background knowledge on the subject. In effect, the democratic component of the equity-oriented pedagogy did not fully accommodate students who needed extra foundational knowledge to participate in dialogues and activities.

In addition, the multimodal pedagogy was inequitable because two students stated that they did not own computers due to their socioeconomic status, and thus had difficulty participating in multimodal forms of communication online. The online course site platform was also inaccessible, since a few student accounts experienced glitches, or their word-processing program was incompatible with the platform, which prevented them from submitting assignments on time. Students also faced difficulties participating in simulations or multimodal activities if they did not possess background knowledge on the topic. Although students appreciated multimodality, many said they could not perform as well as others, because they did not have as much training in drawing, acting, etc. In these ways, the unadjusted pedagogical approaches were inequitable because they prevented various students from fully demonstrating their knowledge and skills.

Student Response to Adjusted Curriculum

However, we noticed considerable changes in behavior after instructors adjusted their curriculum and instructional strategies to meet students' needs and preferences. Instructors made these adjustments by using surveys, assessments, dialogue, and interviews to

identify students' needs and preferred modes of learning. Students stated that their needs include forming original ideas, taking risks, having exposure to clear and engaging instructional strategies, acquiring more knowledge about various perspectives on each class topic, being able to use course content in their final projects, seeing connections between the class and the real world, building community, and being able to demonstrate their knowledge in various ways.

According to the student-focused survey, on average, students preferred that class consist of approximately 71% lecture. They thought that lecture was equitable because they could more readily connect background knowledge with new knowledge. Approximately 94% of students agreed that lecture better equipped them to democratically discuss information and engage in activities. However, based on weekly pre- and post-assessments, students still understood the main points without lecture at the beginning of class. We investigated why these preferences for lecture exist. Some students reported that they preferred lecture since they were not confident in their ideas, placing more trust in the expertise of the lecturer. By contrast, some students stated that they wanted lecture for more efficient reasons. One student wrote: "Lecture is efficient. It tells me what I need to know so that I can do well and get good grades. That's what I need to do to succeed and compete in school and the real world."

The same number of students who preferred lecture at the beginning of class also preferred multimodality and problem-posing dialogues after lecture. They mentioned that these instructional practices helped them co-create knowledge and reinforce lecture materials. Students stated that incorporating various teaching techniques during lecture helped them process information better. Moreover, all students indicated that out of all modalities, visual learning was one of their dominant or preferred modes of learning. One student confirmed the success of the treatment's multimodal lecture approach. This student said that the course's lectures "integrate videos and diagrams that help me visualize information, which connect to and are reinforced by engaging explanations and hands-on activities. Everything was there for a purpose, and it all helped me understand and challenge many complex perspectives and institutions of power."

These needs and preferences influenced course goals and instruction. For example, instructors in the treatment group provided lectures at the beginning of class for foundational knowledge, followed by dialogues and multimodal activities. After observing adjustments in the curriculum, researchers noticed that the course-feedback ratings increased to an average of 6.93 and 7 as a mode and median for the usefulness of teaching techniques. Consequently, the overall average course-feedback rating/ evaluation was 7/7. One student stated: "The comfort of the class size and the structure of the class with opening lectures and following discussion questions allowed me to engage in topics and ask questions more openly than I have been able to in many other classes."

Game-Based Component of Equity-Oriented Pedagogy

As a reminder, the instructors implemented game-based pedagogy by allowing students to redo graded assignments and assessments (Nguyen & Phuong, 2016). In game-based

pedagogy, students earned points for finishing specific tasks, similar to players of a videogame (Dockterman, 2013; O'Rourke et al., 2014; Yee, 2013). For example, students gained points for both individual and collective efforts in class. Students individually earned points for attending class, taking notes, asking and answering questions, demonstrating their understanding of course concepts, and sharing their experiences or insights on course material. Instructors also sought to increase students' sense of community through game-based learning as students collectively scored points. In teams, students supported each other and achieved common goals by answering each other's' questions, validating their peers' classroom contributions, and fulfilling their role(s) in group activities. Moreover, students collaboratively reached a certain number of points to pass each lesson (or level); when they reached a higher threshold of points, they did not need to complete an online assignment because they had already applied course material in original ways. These practices mirror incentives and forms of collaboration found in many video games. As in video games, students would be applying the learning strategies mentioned above to strengthen their skills, in order to achieve an outcome in an engaging, but non-competitive way.

According to interviews, students stated that by redoing assignments in the game-based component of the pedagogy, they focused more on the learning process and strengthening their academic skills, rather than the outcome or grade, which are characteristics of the growth mindset – i.e., the belief that one's intelligence and skills can grow (Dweck, 2006). As one student remarked: "I did not feel dumb or like I was not a human rights person in this class. I just felt like if I tried and worked more in class and on our projects that I would learn more and grow as a social justice scholar. I was never stressed about my class ranking and that's awesome." From interviews, observations, and survey responses, we also noticed that students were motivated to overcome adversity, tackle tough concepts, and take creative risks in a safe space. One student said, "Some of the material was tough … At first I was thinking what is critical cosmopolitanism and how will I ever know, but it was okay because [in the] class [we] helped each other without judging. So I asked questions and kept at it since the gamified classroom created a space where I could apply concepts creatively and do original things until I learned tough concepts." Although we would need to conduct further research to confirm whether this is the case, it appears that characteristics of a growth mindset and positive psychosocial variables (e.g., resilience) are represented in these students' feedback.

In addition, after instructors implemented this game-based system, every student spoke aloud during class, discussed course content amongst classmates, increased note-taking, made more original thematic connections, and improved their performance on weekly post assessments. In fact, one student said: "It was cool that we could say what we actually felt on paper or out loud in the class. I felt that my other skills like listening, talking to other people, drawing, making community, and just thinking were valued unlike in my other classes, where only people who talk a lot look smart." Another student asserted: "I felt safe to take risks, speak my thoughts, and ask no-brainer questions. This helped me learn and understand things better." These students' comments suggest that the game-based element offered students different ways to demonstrate competence and provided opportunities to take risks with learning in a non-punitive space.

Students' comments also suggest how the treatment fostered student engagement because the classroom became a strong community. Within the game-based model, instructors divided the classroom into civilizations that earned points as a group. Based on classroom observation notes, we observed that the game-based model heightened student collaboration because students relied on and supported one another more than at the start of the semester. According to interviews and questionnaires, students indicated that they recognized the value of collective effort over that of the individual.

Stereotype Threat

Researchers also surveyed students about stereotype threat in both the control and treatment conditions. The average stereotype threat score was based on four survey questions asked of the students at the beginning and again at the end of the course. We adapted a procedure and four survey questions that had a high reliability estimate in previous studies (Marx & Goff, 2005; Xavier, Fritzsche, Sanz, & Smith, 2014). The questions asked students if they worried that their ability to perform well in the course is affected by their backgrounds and identities. The questions were on a scale of 1 to 7, with 1 indicating strongly disagree and 7 referring to strongly agree. In this case, lower scores indicate less stereotype threat. The initial average stereotype threat score for both the control and treatment were comparable at the beginning of the course (control mean= approximately 5.2; treatment mean = around 5.5). At the end of the course, students in the treatment condition reported less stereotype threat than students in the control condition (control mean = approximately 4.1; treatment mean = around 2.2). The survey responses at the end of the course suggest that students in the treatment indicated that they had fewer worries about whether their ability is affected by their backgrounds and identities.

Treatment Condition. Based on surveys and interviews at the end of the semester, approximately 76% of students in the treatment reported reduced stereotype threat since they realized that their academic success and contributions were not predetermined by perceptions of their backgrounds or identities. Rather, these students recognized that their success was heavily influenced by 1) their effort and engagement with course material and 2) the support and validation from their peers and instructor. These responses about effort align with the research on how a growth mindset can reduce stereotype threat (Aronson et al., 2002; Blackwell et al., 2007).

Control Condition. While the treatment group showed positive results for reducing stereotype threat, the control group showed mixed results with respect to stereotype threat at the end of the semester. For instance, regarding stereotype threat, about 32% of students in the control group said that the problem-posing and inquiry-based strategies helped them ask questions to peers and instructors to answer what they did not know. These students stated that the process of working with their peers through the game-based pedagogy helped them realize that perceptions of their backgrounds and identities did not predetermine their success. Rather, these students stated that their effort and engagement with course content impacted their success. The same students also stated that opportunities to collaborate with their peers helped them work hard to grasp difficult concepts like the norm life cycle and critical cosmopolitanism. Based on these responses, it seems that

characteristics of a growth mindset and positive psychosocial outcomes (e.g., resilience) are present since they are working hard to overcome the adversity of learning challenging concepts. Nonetheless, we would need to conduct further research to confirm whether this is the case.

However, approximately 41% of students in the control condition at the end of the semester stated that they did not want to ask questions because they were afraid of looking dumb or reinforcing a negative perception associated with their background or identity. This group of students stated that it was difficult for them to participate in the class when they had so many questions and did not have a strong understanding of the course concepts. Additionally, according to surveys and interviews, these students did not report large reductions in stereotype threat. For example, one student stated, "I realize that being an immigrant is what made it so hard for me to excel in this course. Like many immigrants, it's hard for me to understand tough concepts in English." In this case, this student discusses how her perceptions of immigrant identity threaten her academic performance in the class. Moreover, in end of the semester interviews, around 27% of the students in the control condition mentioned that they did not have negative perceptions of how their identities impacted their performance.

Final Student Assessment

At the end of the semester, students in both conditions were interviewed about how the teaching practices and peer-to-peer learning activities impacted their performance on the final assessment. Student responses were examined in light of their performance on the final assessment.

Results suggest that there were different student interview responses based on how well students performed on the final. Some students in the control condition reported not doing well on the final because they had many questions and did not have a strong grasp of the course concepts. In fact, some students reported a sense of confusion as they progressed to the final. For instance, one student stated, "It feels like we're sharing mutual ignorance sometimes. I'm confused and my peers are confused. We're all just rephrasing what other students already said earlier in the class. This was not helpful for helping me do well on the final." On the other hand, other students in the control who excelled on the final stated that the course's engaging nature, peer-to-peer learning opportunities, and the instructors' willingness to answer questions helped them master course content.

Based on interview data, students in the treatment stated that they performed well on the final because the instructors provided feedback on weekly post-tests and regularly reviewed course concepts that students did not understand. One student said,

I helped the teaching team improve my learning and my peers' learning. The teaching team took feedback very well. I felt safe to provide anonymous feedback because there were no repercussions or feelings that the instructors would treat me negatively. I actually felt that I had a voice and that the teaching team actually made changes and collaborated with us – the students – on how to best make these changes through inclusive teaching. I

never met any instructors in other classes who actually made changes based on weekly feedback and ungraded tests. Because of this, I trust the teaching team.

In addition, students remarked that the weekly anonymous course-feedback forms provided them with opportunities to ask questions anonymously and provide specific feedback that could help the instructors enhance student achievement. When commenting on this process, a student remarked, "This all helped me do really well on the final since I received weekly feedback with specific comments and strategies on how I could better meet learning objectives."

Students in the treatment stated that they appreciated the anonymous course feedback forms because they could highlight the practices that made them feel included and/or excluded from the classroom. Moreover, students stated that they were motivated to fill out anonymous course feedback forms because the instructors adjusted instruction and dialogued with students on why they implemented specific changes. Students then offered feedback to the instructors through dialogue and subsequent anonymous course-feedback forms. A student built upon these ideas and stated,

I also provided weekly feedback to the teaching team in order to improve my learning and my peers' learning. The teaching team actually found ways to incorporate what the class said when they reviewed material that we did not understand ... I felt engaged and that I belonged in the course because I had a voice. I also challenged myself to participate in new ways so that I could learn the tougher concepts and skills needed for my final project.

Based on our definition of rigor in the beginning of this paper, the treatment group demonstrated a higher level of rigor in mastering, applying, and synthesizing course concepts on the final assessment. For example, researchers who analyzed the final projects found that students in the control group did not define many of the course's key concepts correctly. In addition, many students in the control condition did not correctly apply and synthesize course concepts correctly, since these students' answers had many misconceptions about these concepts. On the other hand, students in the treatment group surpassed the course objectives for the final.

Self-Efficacy

Based on surveys and interviews, students in the treatment condition indicated a high sense of self-efficacy and confidence with excelling on the final assessment. For instance, in an interview, one student said,

I know they want me and my classmates to succeed, master challenging material, and actually do something impactful with what we learn … The peer validation, feeling of community, and opportunities to receive and incorporate ongoing feedback helped me develop confidence. My confidence and the clear expectations for success made me feel that I could properly apply the complex theories and research from this course.

On the other hand, students in the control condition had mixed responses on surveys and interviews regarding their sense of self-efficacy and confidence with demonstrating mastery of course material.

The questionnaires given at the beginning and at the end of the course also asked students about their sense of self-efficacy. The question asked students about their beliefs in succeeding in the course. The question was on a scale of 1 to 7, with 1 referring to strongly disagree and 7 referring to strongly agree. We see higher scores indicating higher perceptions of self-efficacy. The average self-efficacy score for both the control and treatment were comparable at the beginning of the course (control mean = approximately 3.5; treatment mean = around 3.1). At the end of the course, the average self-efficacy score for the treatment was higher than the control's post self-efficacy score (control mean = approximately 4.9; treatment mean = around 6.8). The survey responses at the end of the semester suggest that students in the treatment indicated higher levels of self-efficacy than students in the control condition.

Discussion

Student Motivation and Academic Achievement in the Treatment Group

Knight and Pearl (2000) claim that students learn more easily in an optimal learning environment that accommodates their needs, preferences, interests, and enhances their satisfaction. In this study, students in the treatment agreed that the democratic pedagogy of working alongside the instructors to co-create this environment facilitated their active participation. Through the equity-oriented pedagogical model, instructors encouraged student motivation to develop original, multifaceted analyses of how normativity is socially constructed. Based on these analyses, students connected their interests and aspirations to the curriculum through a final community- organizing project. As one student commented: "I worked hard on my final project because it was something I designed, cared about, had a personal attachment to, wanted to achieve, related to my career goals, and it affects others."

According to the data regarding final community-organizing projects and grades, students in the treatment challenged themselves and worked hard in this course to earn above a 94%, even though this high level of performance did not affect their grade point average. Many instructors of this course originally assumed that some students would slack off since they only needed to earn a minimum of 70% to pass the class. Based on course feedback/ evaluations, interviews, and survey responses, all students in the treatment reported that they were passionate about their community-organizing project and felt more engaged when the instructors adjusted the curriculum to address their learning needs. In these ways, the democratic component of the equity-oriented pedagogy provided a space for students to engage in work that addressed their passions. At the end of the course, all instructors believed that this process helped motivate students to surpass the learning objectives regardless of the class being Pass/ No Pass.

Moreover, the optimal learning environment helped instructors establish more equitable opportunities and outcomes, even within the context of our definition of rigor. As previously mentioned, we define rigor based on students' ability to meet the collaboratively defined learning objectives and develop their cognitive processes (e.g., defining, applying, synthesizing, evaluating, and formulating concepts) (Davis, 2009; Anderson et. al, 2001). The equity-oriented pedagogy is more dynamic and inclusive compared to the factory model, which focuses on memorization and regurgitation of facts (Perea-Jimenez, 2008). Instructors provided equitable opportunities since students could demonstrate their knowledge and skills through various assessments. We measured rigor using a collectively constructed rubric. Despite being a Pass/ No Pass course, in order for students to earn a 94%, they had to at minimum surpass the goals on the rubric. Since the academic department of the course does not force instructors to sort and rank students, instructors had the agency to evaluate students in ways that promoted collaboration over competition. Thus, instructors evaluated student work using a rubric based on the learning objectives that instructors and students co-created; students did not receive full credit for merely completing their projects.

Moreover, the equity-oriented pedagogical model strove to not replicate the institutional barriers – e.g., race, culture, sexuality, or poverty – that schools often place on those of marginalized backgrounds. Given the demographic data of all students in our study, the student outcomes in the treatment were equitable in that all these students – regardless of race, class, gender, disability – surpassed the rigorous course objectives and earned at least a 94% in the course, despite the fact that course grades were submitted as Pass/ No Pass. Therefore, the data suggests that the equity-oriented pedagogy helped increase equitable opportunities and outcomes for academic achievement.

Transforming the Classroom into a Collaborative Community

One may argue that the treatment's student-centered approach is also market-based in the sense that instructors treat the students as consumers since the instructors aim to provide what students desire. In a consumerist market, the consumer is always right. As consumers, students may believe that they are right because most have paid a high price for their education. Therefore, they want the instructors to give them what is most convenient. However, instructors did not fulfill every student's preferences in class. Instructors framed the classroom as a community in which students expressed their learning needs and visions for an ideal classroom. The agreement was to have multiple styles of instruction that would benefit all learners, albeit at different times during each class. Hence, all students would have a time when the mode of instruction would accommodate their preferred modes of learning. To address students' learning needs, instructors discussed and reinforced the material through varying formats – lecture, discussion, and activities – which targeted the students' preferred modes of learning.

In this setting, the treatment did not adhere to a pure consumer-based approach since it did not fulfill every student's wishes all the time, but rather asked all students to negotiate and democratically establish guidelines that would shape the classroom atmosphere. Therefore, instructors in the treatment did not individualize instruction to each student

but developed an approach that enabled them to adjust instruction to the needs of an entire classroom. For instance, we did not find that academic achievement automatically increased when we accommodated every student's preferred modes of learning or gave each student what s/he wanted. Rather, we observed how the adaptive equity-oriented pedagogy can help students build community, expand their preferred modes of learning, and increase their engagement with challenging curriculum. This collective effort fostered empathy among students; they valued their peers' needs as well as their own. For instance, one student stated:

By hearing my classmates' experiences and learning about their backgrounds and how they learn, I realized that we all had similar personal and academic struggles. This made me realize how we need to accommodate each other's needs and support each other – familia to familia. This feeling of increasing empathy has helped with creating a safe classroom community that strengthened our motivation to collaboratively succeed in this class, which really improved the class' overall learning.

In the treatment condition, students also unanimously voted in class to have lecture, discussion, and activities so they could all have a time where the mode of learning benefited each student. Many realized that a class solely centered on lecture, discussion, or activities may undermine learning and a sense of community for students. According to survey and interview responses, all students in the treatment indicated that this community-building process helped them expand both their preferred modes of learning and the ways they can demonstrate knowledge. One student added:

- Since I empathized with and cared more about my peers, I [...] became more receptive to different modes of learning that were originally out of my comfort zone.
- The gamified pedagogy provided me and my classmates with a safe and non-punitive space where I could make mistakes, focus on learning, and apply my knowledge through new modes or ways.
- As I mastered and became more confident in these modes, my list of preferred modes of learning became much larger.
- Originally, I only liked lecture, videos, and discussions. Now, I also prefer and see how activities, simulations, technology, and active learning can help reinforce new and difficult concepts. This helped me deepen my understanding of the main points in class.
- It's much easier to like a mode of learning when you can perform well with it and benefit from it ... I think this journey has challenged us and improved the learning experience and feeling of inclusion and success in this classroom.

As documented in surveys, all students in the treatment reported that they had opportunities to strengthen their skills in demonstrating knowledge in various modes because the game-based pedagogy provided a safe and non-punitive space for failure and learning. According to our data, students indicated that their achievement improved since they learned in a psychologically-safe and game-based space that offered multiple opportunities for low-stakes assessment and ongoing feedback.

Lecture continues to be perceived as valuable; 67% of students in the treatment stated that they enjoyed lecture because it provided them with the strengths and limitations of at least three or four viewpoints on each topic. The importance of lecture rests on its content, purpose, presentation, and students' reception of it (i.e., how they grasp and transform the lecture's message). One student affirmed that lecture helped her "develop a more critical awareness because the class did not know that some of these points of view even existed, moving away from binary politics in the media." Therefore, we inferred that the treatment's lecture style was not a pure banking method, because the lectures entertained dialogue and did not impose a uniform ideological discourse for academic achievement. The treatment, however, had a banking element because instructors determined which specific points of view to teach. Nevertheless, instructors asked students to critique these viewpoints and introduce new perspectives into the discussion, activities, and/or assessments. Many students debated these perspectives, which altered and redirected their beliefs on each topic. One student recognized that "multiple points of view enabled [her] to have these discussions that expanded [her] awareness, which is useful for the class, social justice, and the final project." One core learning objective was to help students broaden their critical consciousness by analyzing institutions of power, reimagining proposed solutions, and reflecting on the multidimensional ways they approach these topics.

Potential Counterarguments

However, critics of the treatment may argue that the class was not sufficiently rigorous because instructors chose not to follow a tenet of the factory model: sorting and ranking students by grades (Horn Jr., 2006). It is possible to argue that one cannot objectively measure which democratic assessments are better than others, thus deeming our study's assessments less rigorous. One would then claim that accommodating students' funds of knowledge and cultural capital undermines national curriculum, since students are assessed in different ways, making it difficult to compare student progress not only from one school to another, but nationally as well. Based on these premises, one could assert that the treatment's approach is inequitable because every classroom would have a unique assessment model.

We address these counterarguments by redefining academic "rigor" as we mentioned earlier. According to the factory model, rigor refers to solely memorizing, regurgitating, and applying the instructor's opinions (Perea-Jimenez, 2008). This definition does not allow for an expansion of one's critical consciousness, which is necessary for more advanced problem-solving. Unlike the factory model, the treatment (i.e., the adaptive equity-oriented pedagogy) allowed students to have multiple answers and interpretations of simulations posed in the classroom. Consequently, all students in the course proposed multiple answers and suggested diverse solutions to complex, worldly problems. We defend our definition of rigor because exposure to only the instructor's viewpoints and approaches causes students to internalize those ideas as *the* answers. Likewise, most punitive grading and standardized exams within the factory model pressure students to determine the *one* correct answer – therefore suppressing creativity and spontaneity in their thought processes. Furthermore, there is no definitive proof that these exams increase

achievement, and evidence suggests they hinder student outcomes and have not decreased inequality across groups (García Bedolla, 2014).

By contrast, the treatment's democratic assessments encouraged students to devise multiple original answers to solve social problems for which there exists no single answer. The treatment required students to practice the art of critical inquiry (i.e., researching social justice issues and collecting project resources) and effective collaboration – skills necessary for success in most professional contexts. For example, one student asserted that "putting on a successful event was much more difficult than a multiple-choice exam or essay. We had to work together and find relevant information (about our issue and much more), organizations, and materials to make our project happen." Another student corroborated the need to compromise and collaborate, stating: "We had to negotiate competing interests […] We had to alter the theory to make things work." Similarly, one student commented: "Many of these real-world skills, which are necessary to learn, are not even taught in other classes. The norm life cycle [a model that activists can use to frame, disseminate, institutionalize, and consolidate new norms for social justice] was so useful for implementing my project and responding to obstacles." From these and other similar statements, we concluded that the treatment's approach was successful in teaching students beneficial professional skills that were collaboratively established as course objectives: questioning the status quo, conducting research, acquiring project resources, and collaborating effectively. Assessing students' ability to think outside the box and work with others is inevitably a subjective system, yet fitting for our purposes nonetheless. In conclusion, according to surveys, instructor evaluations, and interviews, all students reported that the treatment (i.e., the adaptive equity-oriented pedagogy) cultivated a safe and supportive learning community where they could move outside their comfort zones, empathize with their peers, and expand their preferred modes of learning in multiple ways. Consequently, students took risks and practiced new ways of demonstrating knowledge that helped them build real-world skills.

Limitations and Suggestions for Further Research

One limitation to our study is that the treatment's method of instruction does not suit every classroom, instructor, or student. The elective course being studied offers more flexibility to pass students and does not face the same institutional barriers as other courses. For example, instructors of non-elective courses may be reprimanded or not rehired for giving every student a 94% or higher. Additionally, many K-12 teachers must follow a curriculum centered around standardized exams if they want to remain employed. These instructors have to teach a curriculum based on the textbooks or materials they receive from a school, limiting *how* they teach and evaluate their students. Non-elective instructors also teach courses that are part of a larger state-wide curriculum or need to provide students with foundational knowledge and skills for a major requirement or future courses in a major.

Rather than having to adhere to the requirements of a major and/or institution, instructors were able to pass or fail students based on learning outcomes the instructors and students created. Since the course was Pass/No Pass, it is possible that students freely voiced their

opinions and focused on learning, rather than on grades. In many non-elective classes, students often depend on and reiterate the instructors' opinions because reproducing the taught material has been commonly used as a strategy to obtain high grades. However, this system does not necessarily encourage students to think spontaneously or independently.

Our sample also presented several limitations. For one, many students selected the course, because they were already passionate about social justice. However, we administered an intake survey and found that students enrolled in the course for a variety of reasons, such as fulfilling the minimum unit requirement or taking a course with their friends. Nevertheless, it would be useful to test the different teaching methods on a mandatory course to determine if students who are not genuinely interested in this subject would undermine classroom management, engagement, and productivity.

Another limitation is that approximately 94% of the students requested lecture at the beginning of class, which influenced instructors to cater to that preference. Future research is needed on a student population that has not been conditioned by lecture and/or the factory model to determine if our findings remain consistent. Arguably, we did not have a large student sample in which equity and access are commonly thought to be an issue; university students are typically perceived as part of an overall privileged population, especially if they attend a top-tier university in the US.

Given these limitations with the research sample, it is worth rethinking whom the instructors admit into the course in order to maximize diversity and equity across the courses; in these courses, one may argue there were a few underserved students since they were college students at university. Conducting the study with a higher percentage of underserved students in a different context should be pursued to illuminate how race and SES may impact academic achievement. Furthermore, the above limitations of our sample population may present issues in applying the adaptive equity-oriented pedagogical model to all classrooms. Therefore, further research needs to be conducted to determine whether this equity-oriented pedagogy can be scaled and if it can address broader issues of equity and access in multiple classrooms and educational contexts.

Recommendations for Designing Curriculum

Although the treatment may not be suitable for every student, teacher, or classroom, we offer the following recommendations based on our findings and discussion:

1. Build rapport and a strong relationship with every student based on a democratic, collaborative, comfortable, and open environment without repercussions.
2. Identify and address barriers to equity, access, and inclusion (e.g., stereotype threat) in the classroom.
3. Document students' interests, background knowledge, aspirations, and preferred modes of learning; use this information to design multimodal curricula, instruction, and assessments that appeal to students' intrinsic motivations and their learning needs (i.e., strengths, interests, and areas for growth) (McCallum, 2013).

4. Align curriculum, instruction, and rubrics with assessments and learning objectives (Wiggins & McTighe, 2005); incorporate meaningful assessments (e.g., project-based learning) to connect curricula to a larger purpose, event, issue, student interest, or activity that extends beyond the classroom.

5. Articulate instructional goals/ learning objectives and expectations to students. Make sure classroom instruction and activities fully prepare students for rigorous assessments. To clarify expectations for assessment and monitor student learning, instructors can regularly administer ungraded formative assessments (e.g., like the pre- and post-tests in our study), which have questions that are similar in rigor to graded summative assessments. After addressing students' misconceptions from formative assessments, instructors can make their expectations and thought process explicit by modeling how they expect students to approach a problem or task with step-by-step instructions. Then, the instructors can ask students to practice these skills in class followed by feedback. Instructors can then offer opportunities for students to incorporate feedback in future assignments and class meetings.

6. Develop meaningful ways to evaluate and adjust instruction through student-assessment data, classroom observations, open dialogue, and anonymous course-feedback forms or evaluations.

7. Interpret ongoing feedback and assessment data as an asset for diagnosing challenges in the classroom, innovating instruction, addressing student needs, improving cultural consciousness, and developing a growth mindset as an instructor.

8. Offer examples of constructive feedback that can help students provide useful suggestions for improving teaching on anonymous course-feedback forms. To address conflicting student feedback, develop and implement norms with students on how you are addressing various learning needs at different times in each class meeting.

9. To strengthen relationships in the classroom, ask students to validate and affirm their own and their peers' contributions to learning (Hurtado, Alvarez, Guillermo-Wann, Cuellar, & Arellano, 2012; Cohen et al., 2006). If time in the classroom is limited, instructors can create a thread on a learning management site or a physical board where students can post validation comments about each other. Instructors could also pair students up to write a short note of validation to each other after class.

10. Consider employing game-based learning where students have multiple opportunities to
    a. focus on mastering course content where they can redo assessments or retake another assessment that measures the same learning objectives.
    b. demonstrate knowledge in new ways in a nonpunitive learning environment; the goal is to create a psychologically safe space for learning, expanding skill sets, and taking risks.

11. If applicable, teach current examples or case studies of how leaders are successfully and not successfully implementing course concepts to address real world problems. To make these lessons relevant to students, ask students to synthesize course concepts and their experiences to improve and construct solutions to real world challenges.

Implications for Policy and Practice

We aim to improve equity for all college students by contributing an adaptive equity-oriented pedagogical methodology that we have refined through collaborative, mixed-methods research. The equity-oriented pedagogy could be applicable across disciplines since it promotes evidence-based teaching practices that can be used in many different types of colleges courses. For example, formative assessment can be used in many courses to identify and address students' learning needs (i.e., their strengths, interests, and areas for growth). In addition, the pedagogy offers a teaching approach that incorporates student voice through weekly course feedback, surveys, and project-based learning. These strategies can be useful and valuable across disciplines, especially for college instructors who wish to address students' learning needs in an inclusive way. While this pedagogy does take additional time for student and instructors, technology can transform the assessment and survey process so that instructors can focus more on analyzing student data and improving student learning. This can be a feasible way of building the assessment and survey process into regular course activities.

Centers for teaching and learning (i.e., faculty development centers) can provide models of what equity-oriented pedagogy looks like in practice, such as the examples presented in this study. These examples can help faculty understand, feel, and experience how the pedagogy works. Furthermore, centers for teaching and learning, along with equity and inclusion units, can provide programs and guides that equip instructors to use equity-oriented teaching practices. For instance, these programs can support instructors with strategies for implementing ongoing formative assessments and game-based learning.

Based on our research, we encourage continuous attention to equity-oriented practices through which faculty can see highly motivating results (e.g., higher student learning gains and course evaluation scores) of ongoing pedagogical improvements (M. Miller, personal communication, April 11, 2017). This process can also help faculty identify their strengths and find ways to improve their teaching based on classroom data (Freishtat, 2016). These strategies would be useful for instructors who seek to improve their practice in ways that are inclusive rather than punitive (Freishtat, 2016).

Some of the practices from this equity-oriented pedagogy may be particularly useful for academic departments, universities, and schools that are focused on narrowing academic achievement gaps, especially for historically underrepresented students. These institutions might begin by comparing how their current practices and equity-oriented pedagogies impact students' academic trajectories in higher education.

These measures and metrics of equity-oriented practices can be useful for program evaluation, ongoing curriculum development, and faculty development. This program evaluation model can allow researchers and administrators to judge the efficacy of pedagogical interventions on students' academic and psychosocial outcomes. Institutions can incorporate these measures and metrics of equity-oriented practices in job descriptions, promotion, awards, and tenure reviews. This process can incentivize faculty and professionals

to value equity and inclusion. We believe that these practices can support faculty and professionals to transform classrooms into equity-oriented learning environments.

Conclusion

The results of our study show that transforming classroom environments can address the increasing diversity in today's classrooms. Curiously, the site of our study rests on land susceptible to frequent seismic activity. Just as engineers have redesigned campus buildings to protect occupants, instructors in the treatment redesigned their classroom structure to establish a flexible yet secure environment for students to feel protected, accepted, and supported by a community – all of which foster greater expression and academic growth. This adaptive pedagogical model enabled instructors to better meet student needs and provide greater equity and access, thus avoiding a structural collapse from the rigidity of a one-size-fits-all model of instruction. The rigid factory model fails to respond to scholarly tremors (i.e., clashes in cultural views and critical interpretations), which result in inequitable, inaccessible, and unstable classroom environments; whereas the adaptive equity-oriented model accounted for these shortcomings. This pedagogical model is useful to instructors who seek to understand their students' unique needs and preferences, which have been influenced by larger structures and institutions. Not only is our study advantageous for instructors teaching social justice courses, but also for those concerned with inequity and how social justice issues destabilize the classroom.

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Appendix A

According to Figure 3 below, in Weeks 2, 5, and 8, the average gain scores of students in the treatment group had a pattern of increase among the female, male, and gender non-conforming groups. This pattern is not consistent for the female, male, and gender non-conforming groups in the control group.

According to Figure 4 below, the difference between the average gain scores among immigrant, second-generation, and non-immigrant students in the treatment and control groups is largest within weeks 8 and 9.

Based on Figure 5 below, the difference between the average gain scores between students with and without disabilities between the treatment and control groups is largest during weeks 8-10.

According to Figure 6 below, while male and female groups exhibit a similar pattern in average gain scores, the gender non-conforming group may be more erratic since it has fewer students in the control (*n = 6*) and treatment groups (*n = 3*).

According to Figure 7 below, in both the treatment and control groups, second-generation immigrants with and without disabilities appear to have similar average gain scores in the beginning, but have larger differences in average gain scores at the end.
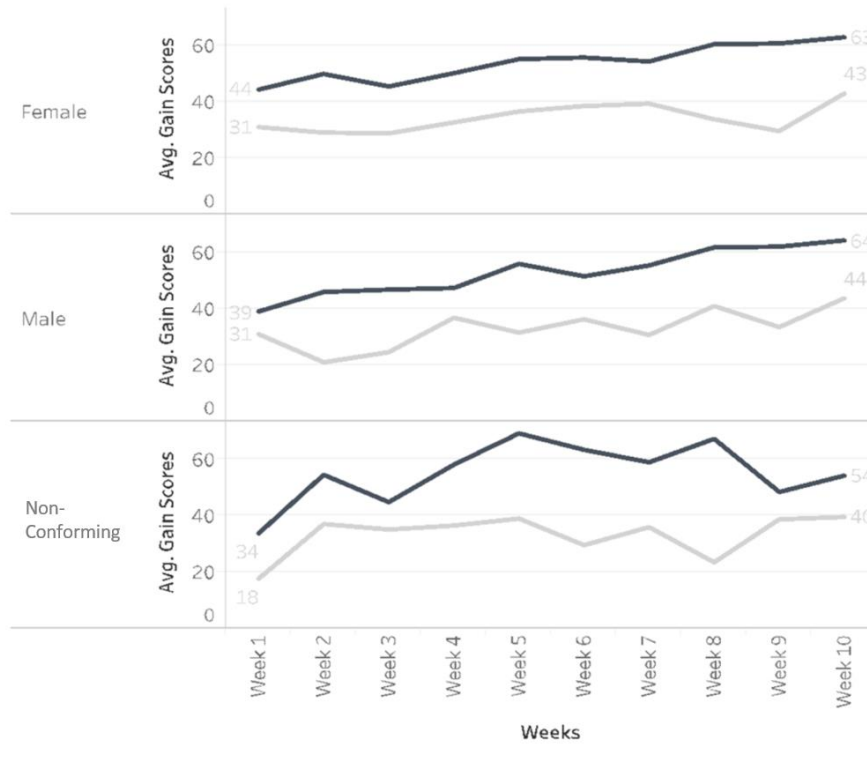
Figure 3. Students' average gain scores by week of course, controlling for gender.
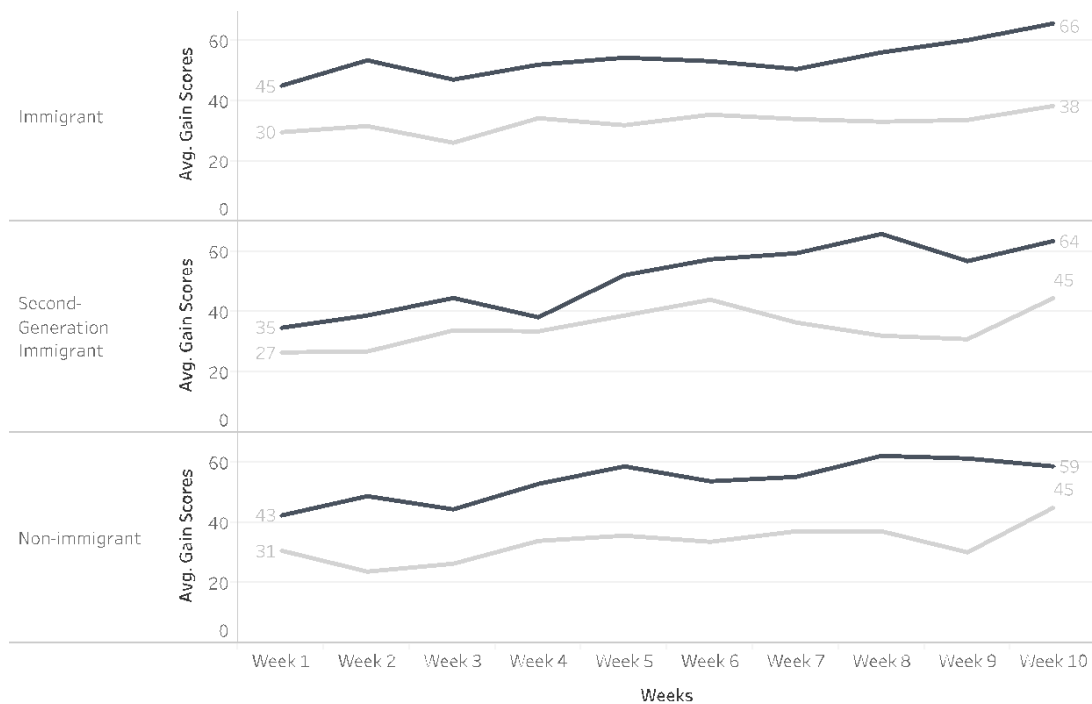
Figure 4. Students' average gain scores by week of course, controlling for immigrant status.
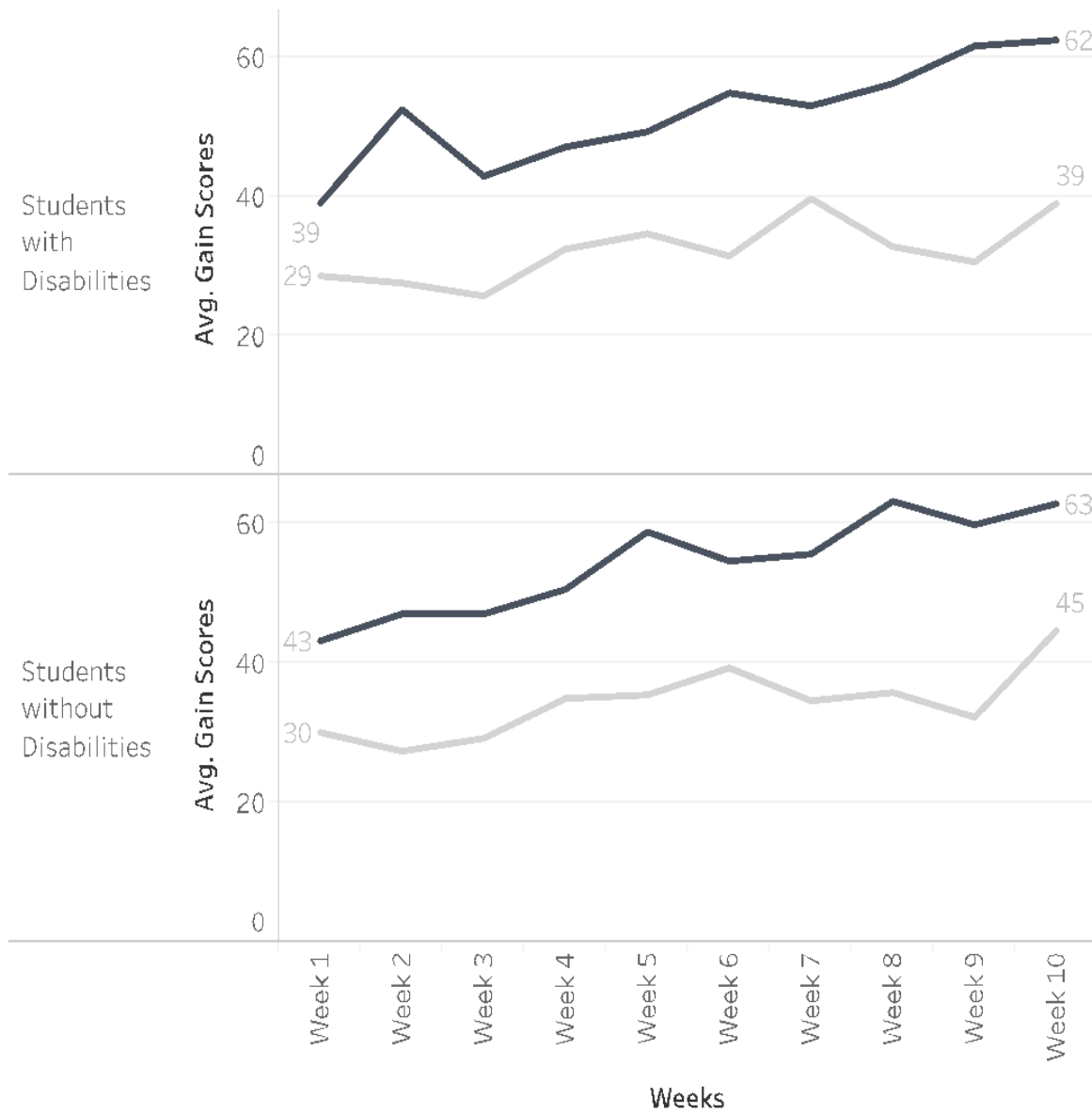
Figure 5. Students' average gain scores by week of course, controlling for disability.
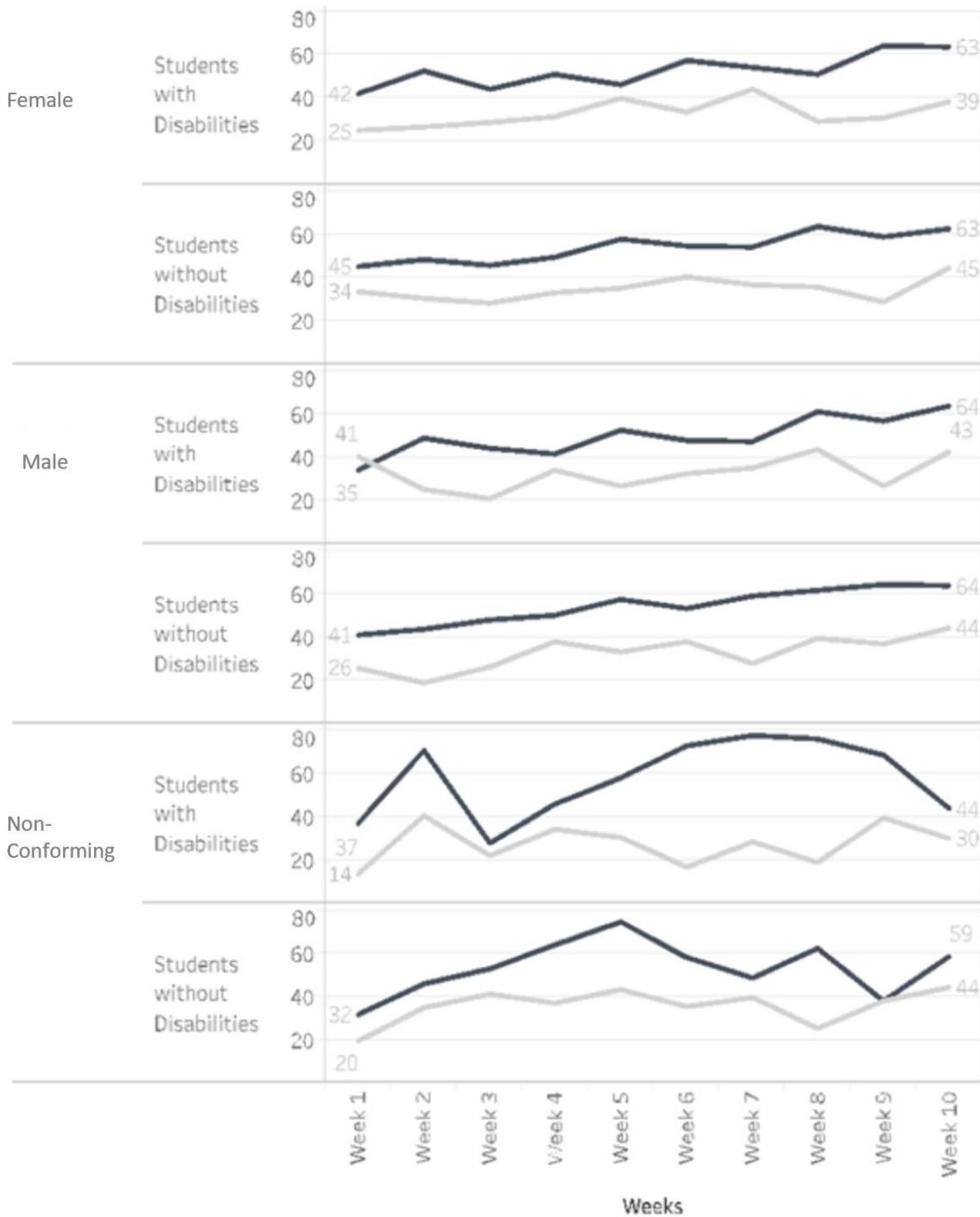
Figure 6. Students' average gain scores by week of course controlling for gender and disability.
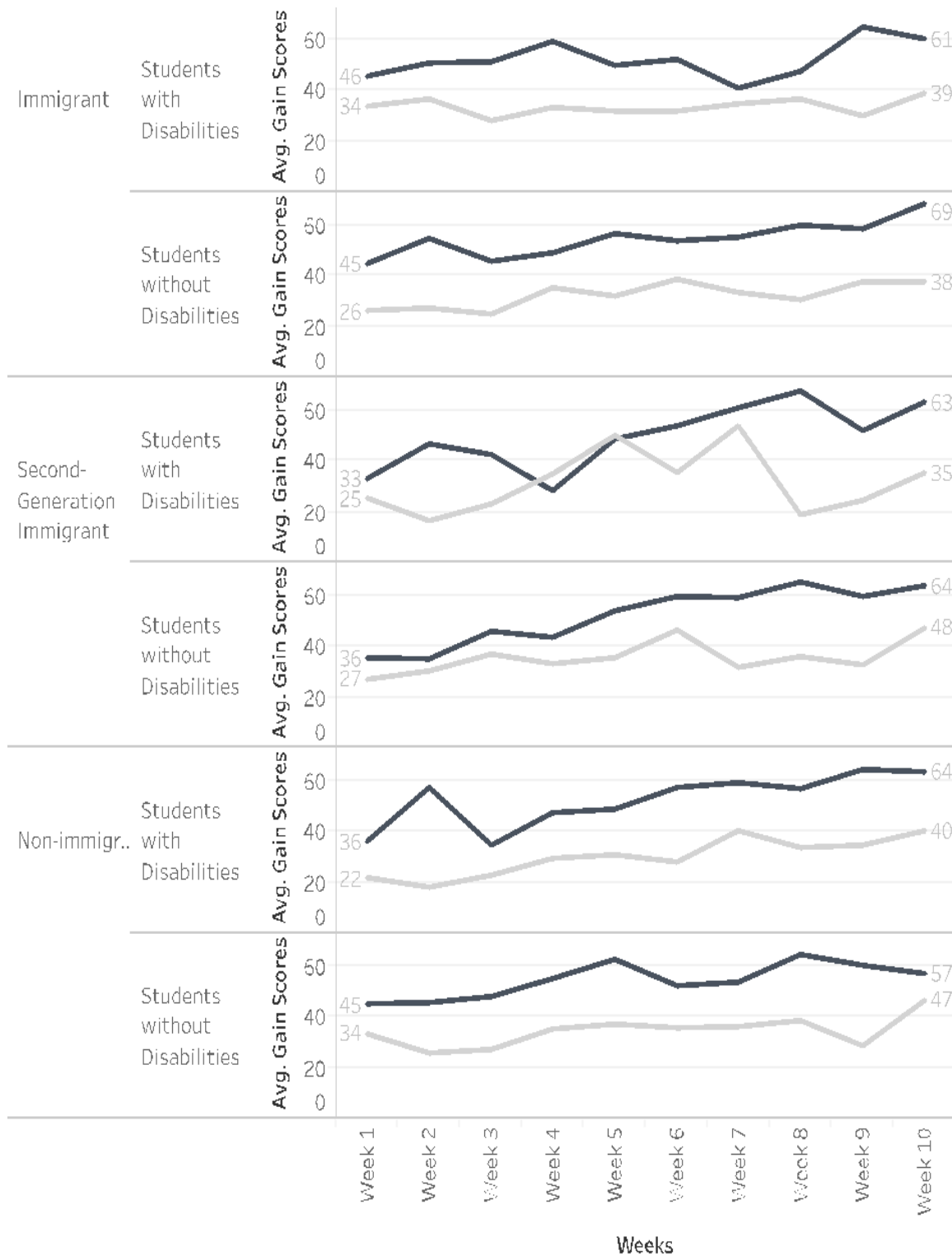
Figure 7. Students' average gain scores by week of course controlling for immigrant status and disability.

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