

**“STICKY AND COMPLICATED”: TOWARDS REMOVING INEQUITY IN
ACADEMIC PROGRAM DESIGN**

A disquisition presented to the faculty of the Graduate School of
Western Carolina University in partial fulfillment of the
requirements for the degree of Educational Leadership.

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ABSTRACT

“STICKY AND COMPLICATED”: TOWARDS REMOVING INEQUITY IN ACADEMIC PROGRAM DESIGN

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Western Carolina University (April 2024)

Chair: Dr. Dustin Evatt

The research addresses how post-secondary education can enhance Black student participation in STEM fields, which historically lag behind their White counterparts. Through improvement science, the researchers test the effectiveness of providing scaffolded learning and awareness modules for faculty and staff to enhance curricular design efforts and facilitate discussions on addressing issues affecting Black student success. Utilizing qualitative analysis, they find that participants shifted their focus from institutional responsibility to personal actions to support Black students. The study recommends integrating equity-focused learning for education leaders and emphasizes the importance of data-informed decision-making with disaggregated data in addressing inequitable outcomes. Future research should consider the evolving language and social context impacting educational equity efforts.

The Disquisition

The disquisition is formal, problem-based discourse. The disquisition is closely aligned with the scholar-practitioner role of Doctorate in Education (Ed.D.) students and thus takes on a practical focus rather than the theoretical focus of traditional Ph.D. dissertations. The purpose of the disquisition is “to document the scholarly development of leadership expertise in organizational improvement” (Lomotey, 2020, p. 5). The Ed.D. program at WCU nurtures and matures students as both scholars and practitioners who are trained to understand systems and institutional challenges and opportunities through a lens of research and scholarship. Students apply their knowledge, using their institutional access and positionality, directly to the educational institutions where they lead. The Ed.D. is an applied degree, and the disquisition is similarly an applied capstone experience for doctoral work. The disquisition at WCU specifically utilizes an Improvement Science methodology, is shaped by critical theory and scholarly research, and engages the candidate in the application of the concepts in an applied manner through the development and implementation of an intervention within their local institution, focused on improvement of equity within that system. Ultimately, the disquisition serves as documentation and assessment of an improvement initiative that “contributes to a concrete good to the larger community and the dissemination of new relevant knowledge” (Lomotey, 2020, p. 5).¹

¹ Statement prepared by Alison Joseph, Ed.D. and WCU Educational Leadership faculty

“Sticky and Complicated”²: Towards Removing Inequity in Academic Program Design

Student preparation for post-secondary success varies across the public K-12 landscape. A student’s zip code is predictive of their academic and economic success due to many factors, including disparities in funding across the K-12 public educational system (Chetty et al., 2018; Corneille et al., 2020; Tilsley, 2017; Wojcik & Palochko, 2019). Areas with higher income levels and greater property taxes allocate more funding for K-12 schools, thus leading to more resources for academic preparedness and student success for higher education degree completion. Students that arrive at higher education institutions less prepared for academic success are more likely to be delayed in progress and completion of their degree. This delay is created because the student must add additional classes to their college plan to become college ready. Mishkind (2014) defines college ready as the knowledge and skills for succeeding in a curriculum, and more specifically, being qualified to take the institution’s introductory courses. Institutions use methods such as the Department of Education’s measure of high school curriculum rigor, high school GPA, and college entrance exams (i.e. SAT and ACT) (Janice & Voight, 2016).

Post-secondary education curriculum is often designed without using an equity-centered approach whereby some instructors assume that all students have the same level of high school preparation. Institutions fail in their responsibility to educate all students with equity when they design a program pathway and require a course, such as calculus, in the first term when not all incoming students have access to precalculus courses at their high schools. This approach, referred to as curricular complexity, inhibits students’ progress and completion toward a college

² This is a quote from Participant 1 that the re quote describing the efforts to do equity work within the current state of anti-DEI related legislation or potential legislation that creates fear and confusion for faculty, staff, and students.

degree (Heileman et al., 2017). Curricular complexity negatively affects Black students at higher rates and perpetuates social and economic inequities (Seymour, 2001; Suran, 2021). The curricular complexity is not the inherent intellectual complexity of the subject matter; rather our focus is on reducing the unnecessary structural complexity of curricula and creating transparency in programs, process, and policy for faculty and students. Making the curriculum accessible and transparent provides a more level academic playing field for students regardless of their social, financial, and cultural capital backgrounds. Curricular complexity can extend the time to degree completion anywhere between 6-24 months. Delayed degree completion means a higher cost for a student's degree. Students with less resources and a dependence on financial aid are often those with less high school preparation and must complete their degree within four years before their need-based aid runs out (Van Dusen & Nissen, 2020), thus creating further inequities and issues for student graduation rates.

Problem of Practice

Despite years of research, best practices, and increased funding, the changes in who achieves a STEM degree has changed little (Handelsman et al., 2004; Seymour, 2001). While we do not think that students should be removed from the landscape of solutions when trying to increase student success, we suggest institutions turn a critical lens on itself to reflect on its policies and practices to consider how their practices might change to increase student success of Black students in STEM programs. The problem of practice addressed in this improvement initiative is that post-secondary degree attainment by Black students in science, technology, engineering, and mathematics (STEM) programs lag those of White students despite years of programs intended to increase the number of STEM degrees awarded to Black students. This lag

in STEM degree attainment has occurred despite decades of high impact practices and other researched-supported pedagogies focused on college students, which are well-known, but not widely implemented (Elrod & Kezar, 2017; Felten, et al., 2016).

While institutions have been deficient in scaling implementation of good practices to support Black students, institutions and researchers also use language that lays blame on the student for factors that affect their success such as race, ethnicity, and socio-economic status. Instead of attributing blame to an individual, it is crucial that institutions take a structural and systemic approach to curricular complexity³. Consequently, this leads to equitable access and support so all students, in particular Black students, who want a STEM degree can succeed in a curricular program regardless of their K-12 experiences. Ultimately, this improvement initiative focused on increasing faculty capacity through equity-focused professional development workshops to disrupt reproduction of social and institutional inequities enacted through curricular complexity.

Review of the Literature

Loza's (2003) research highlights the importance of understanding that economic and social mobility is challenging to achieve because educational systems reproduce social inequities in educational systems, to move beyond deficit thinking, blaming the victim, and cultural differences (Loza, 2003). Because educational systems are established by the White middle class, it is structured on their social and cultural values and knowledge (Loza, 2003). The White middle-class structure of education means non-White and economically disadvantaged people are not setup to succeed within society. Using Bourdieu's (1977) cultural reproduction and social

³ We have provided a brief description of the curricular complexity tool and metrics in Appendix A.

reproduction theory, Loza (2003) cites the unfavorable circumstances of schools situated in low-income and minoritized areas as both physical and academic in nature. According to Loza (2003), the factors in place that create poverty for people and communities are reproduced in schools because people living in poverty do not have the social and economic capital needed for social mobility. Bourdieu concluded in his *Cultural Reproduction and Social Reproduction* (1977) research that education should create equality and allow low-income and minoritized students to gain social and cultural capital required for social mobility (Bourdieu, 1977; Loza, 2003). Additionally, studies find that some faculty expectations are an important area to address when attempting to increase student success across all student communities. Despite efforts that address and attempt to help students, students operate within a system designed by some faculty that believe ability is fixed and students are not able to succeed. Given this possible fixed mindset, some faculty members intentionally design gateway/feeder courses that are meant to keep certain students out (Canning et al., 2019).

Racial Inequity in STEM Programs

Research indicates that Black students are less likely to graduate with STEM degrees compared to White and Latino students (Tsui, 2007). The accreditor of engineering schools, ABET, provides data showing that Black graduates account for only 4.2% of undergraduate engineering degrees (Milligan, 2020). However, Black students start their higher education career in a STEM course at rates similar to White and Latino students, yet they change their major or do not persist to graduation at the same rate (Riegler-Crumb et al., 2019; Sithole et al., 2017). Along with hundreds of studies showing the lack of success of Black students in higher education, there is also research showing that high impact strategies used to improve student success may not improve equity in classrooms or the success of Black students (Gándara, 1999;

Laws, 1999; McGonagle et al., 2014, Tsui, 2007).

While many factors impact a student's success in college, acceptance into an institution represents that institution's agreement that the student will succeed in their desired degree (National Science Foundation, 2017), The Postsecondary Value Commission created a series of reports on various factors that post-secondary institutions need to address to make access and success more equitable. Baker's (2021) report for the Postsecondary Value Commission argues that race and class are necessary components in reforming the post-secondary system. In particular, the report identified barriers to equitable success in higher education that are driven by characteristics of pre-postsecondary education and outside the control of the student and post-secondary education structures around social and financial capital (Baker, 2021). Higher education structures control and maintain these barriers with opaque institutional policies and practices that inform program design and course complexity.

Current Efforts and Outcomes

Degree programs and their accompanying curriculum plans present a problem because their design was for a different purpose. Academic programs intentionally kept student enrollment low by "weeding out students" because the capacity of science, technology, engineering, and math (STEM) programs could only facilitate a small number of students (Chawla, 2020). Currently, post-secondary institutions are trying to produce more STEM majors (U.S. Department of Education). The Chronicle of Higher Education published an article questioning institutions' efforts to provide a "coherent curriculum and smooth the path" for student success (McMurtrie, 2021). The article focuses on the lack of attention to program design and the organic growth of program corequisites and prerequisites, and how those factors can create a program that increases the time to degree for students (McMurtrie, 2021).

A report from the U.S. Department of Education shows a student's chance of receiving a degree is reduced by more than half if they receive a non-passing grade such as D, F, W (withdrawals), and I (incomplete) (DFWI) for 20% or more of their courses (Adelman, 2006). For a typical five course term, this percentage represents one course if the student is taking five 3-credit courses per term. Essentially, the design of programs to combine difficult courses means that Black students are steered away from majors that require calculus or other high DFWI courses, so they complete a degree successfully and within their four-year allotted time (Hatfield et al., 2022; McCoy et. al., 2017). Inequity with the default degree program layouts assumes equal learning availability in secondary school offerings when they are, in fact, not equal. This proposal focuses on creating a means to review, analyze, and redesign programs at colleges and universities to provide equity in degree attainment by making degree plans fit into a four-year plan.

There are Faculty that often view the courses they teach as being connected to one or a few courses in the program curriculum. However, with a minimum graduation requirement of 120 credits, students must take approximately 40 courses at 3 credit hours per course. Students are urged to take 15 credit hours per term – approximately five courses - to graduate within four years. Without taking prerequisites into consideration or the combinatorial number of options, the magnitude of choices makes this difficult for students and advisors to review. The task becomes logarithmically complex if you want to explore ideas outside of predetermined program requirements, you transfer from another institution, or you want to create a custom program of study or dual major. Educational outcomes in elementary and secondary school and college readiness are influenced by student demographic characteristics, which encompass racial, geographic, and economic factors, and are themselves affected by structural racism and

economic disparities. The racial and economic inequities created by K-12 educational systems are sustained and perpetuated in post-secondary STEM degree programs through course complexity and result in greater financial burden and decreased opportunity for success and degree completion.

Who Does Curricular Complexity Affect?

The inadequacies of the K-12 educational system to prepare students for success in higher education serve to delay a student's progress through a program by extending a student's overall time toward degree completion. Students who have fewer financial resources to pay for more credit hours is yet another barrier to student success and access. Research indicates that curricular complexity disproportionately affects racially minoritized students in multiple ways (Hatfield et al., 2022). Specifically, Black and African American students, who intend to obtain a STEM degree and are equally academically prepared, are prohibited from degree completion by course sequencing and program complexity. The social and economic impact of program complexity is that Black students are underrepresented in degree attainment in science, technology, engineering, and mathematics (STEM) degree programs and careers (Corneille et al., 2020). Across higher education, Black students make up only 12% of STEM majors (National Science Foundation, 2017). There are many social inequities and injustices created and perpetuated by the lack of diversity in STEM degree attainment. Hatfield et al., (2022) highlight these social inequities by stating, "Science technology, engineering, and mathematics (STEM) requires equity, diversity, and inclusion. When these are lacking, public health is hurt, scientific innovation and creativity are reduced, and economic growth is hampered" (p.1).

The lack of diversity in STEM careers blocks progress in fields - such as healthcare – as well as science innovations that improve people's lives and society. Economic injustice is

maintained and perpetuated when Black students are blocked from the social and economic mobility that come with high paying STEM occupations. According to a 2022 report from the U.S. Bureau of Labor Statistics, the top 20 highest paying occupations are exclusively medical and engineering jobs. A 2015 report by the National Science Foundation (NSF) indicates that of all the graduates working in science and engineering occupations, only 2% were Black women and only 3% were Black men. Furthermore, a 2019 Department of Education report states that the median annual salary four years after graduation for STEM majors has increased from \$53,800 to \$61,700 between 1997 and 2012. While the same statistic for non-STEM majors decreased from an annual salary of \$41,900 to \$36,600. This data shows that Black students do not have equitable access to STEM degrees. This lack of access to STEM degrees for Black students prohibits social mobility by keeping them out of STEM careers, which have the highest annual incomes in the job market.

In STEM programs, introductory courses are often prerequisites that require a passing grade to advance in the program. Even when we statistically control for high school preparation or a student's intent to obtain a STEM degree, White male students that complete the STEM introductory courses with at least a C grade or higher are 48% more likely to complete a STEM degree (Hatfield et al., 2022). Additionally, minoritized female students are 35% less likely to receive a STEM degree, and if the minoritized female students receive a C in any introductory STEM course, the chance of obtaining a degree drops to 21%. Therefore, the curricular complexity in STEM programs often creates greater disparities and lessens the probability Black students will obtain a STEM degree.

Causal Analysis of The Problem

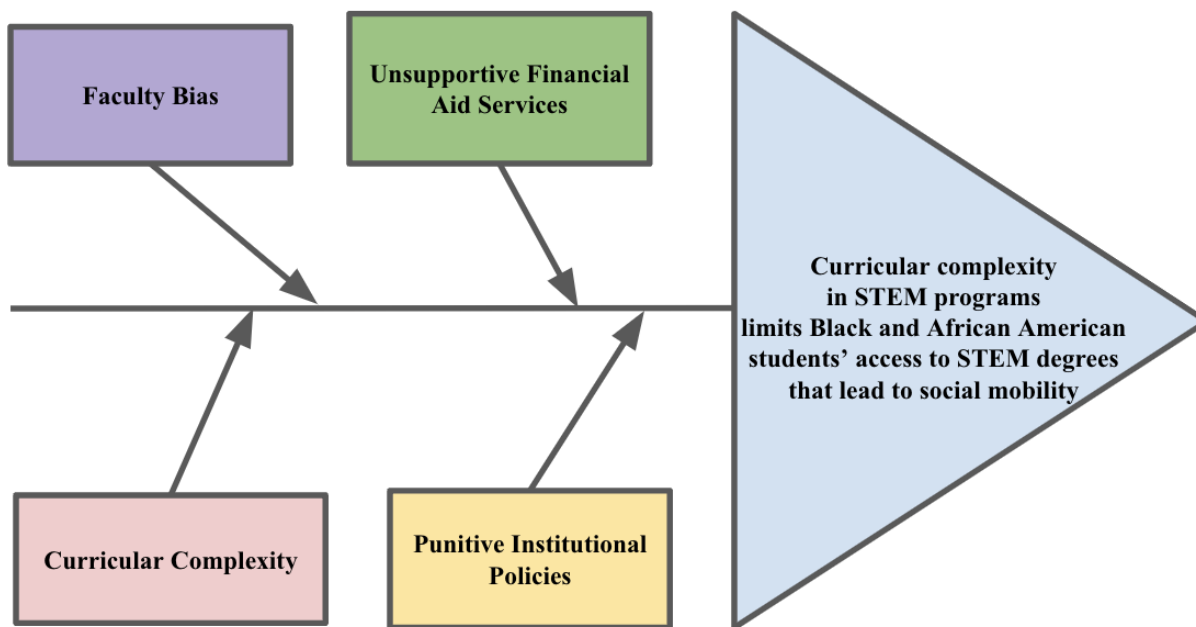
We began analyzing the issue of how curricular complexity in STEM programs limits

Black and African American students' access to STEM degrees that lead to social mobility. using a causal analysis process and diagram, also known as a fishbone or Ishikawa diagram (Bryk et al., 2017), as well as the five whys protocol (Hinnant-Crawford, 2020). A causal analysis is an improvement science tool used to, “make visible organizational and structural policies at work” (Bryk et al., 2017, p. 65). The causal analysis, shown in a fishbone diagram (Figure 1), highlights the central factors leading to curricular complexity in STEM programs limiting Black and African American students' access to STEM degrees that lead to social mobility. Figure 1 reflects the causes as the bias of some faculty, financial aid services, curricular complexity, and institutional policies.

Each of these factors are the parts of the system that perpetuates unjust student outcomes because they treat students as if they all have the same access to social and economic capital for success before arriving to the program and to succeed in the program. Figure 1 identifies and labels inequities as they are in the real world of higher education. Many inequities are invisible when conducting causal analyses because the nature of implicit biases is they are embedded in the individuals who created our education system.

Figure 1

*Causal Analysis Diagram*⁴



Faculty Bias

The fishbone diagram (Figure 1) reflects faculty members' beliefs that not all students can succeed as a causal factor that inhibits completion rates for Black students in STEM programs. The sequential nature of STEM curricula has led some faculty to use introductory courses that students must pass to remain in the program, as a method to purposely “weed out” students from progressing through the major. Because some faculty do not believe all students can be successful, some faculty believe they are expected to serve as gatekeepers of who gets to participate in STEM programs (Canning et al., 2019). Another gatekeeping strategy is the use of SAT or ACT test scores for colleges for admission. The SAT test intends to measure innate

⁴ The fishbone diagram is an amalgamation of different discussions throughout the writing process.

intellectual ability and not the economic and family privilege that predicts high SAT test scores (Tierney et al., 2002).

These gatekeeping strategies of college admissions and some faculty bias reduce access to STEM degrees and STEM careers that makeup the top 20 highest paying occupations thereby halting the social mobility of Black students. This is clearly illustrated when examining the data showing that Black students make up only 12% of STEM majors in higher education and that of all the graduates working in science and engineering occupations, only 2% were Black women and only 3% were Black men (National Science Foundation, 2017).

Unsupportive Financial Aid Services

The causal analysis diagram cites financial aid services that do not support the financial needs of students as a causal factor of complexity in STEM programs that limits Black and African American students' access to STEM degrees that lead to social mobility. Burmicky and Duran (2022) found community college students reported access to knowledgeable financial aid officers as a significant factor for student success. Community college students reported barriers they face because financial aid officers were unavailable or unable to answer their questions.

Financial aid officers feel limited in their ability to serve students' holistic financial needs. The lack of capacity of financial aid officers has a negative impact on students' ability to persist to completion (Burmicky & Duran, 2022). The same research concluded professional development for financial aid officers to serve students' needs to remain in school. In the current system of four-year institutions, if a student fails any single course in any typical course term, their chance of receiving a degree is cut in half, and not being enrolled full-time may reduce and jeopardize financial aid funding, often utilized by and necessary for Black students to fund their post-secondary education (Adelman, 2006).

Curricular Complexity

Current academic research literature and data support course complexity as a root cause that inhibits completion rates for Black students in STEM programs. STEM courses are highly sequenced creating blocking factors that lead to curricular complexity. This complexity makes STEM programs particularly challenging for students to complete (Grote et al., 2020).

Even when examining STEM students who transfer from a community college, their graduation rates from four-year engineering programs lag behind students that did not transfer from a two-year institution (Grote et al., 2020). This lag in graduation rates for transfer students points to racial inequities in STEM degrees because minoritized students are the majority of students enrolled in community colleges (Lattuca & Stark, 2009). Research indicates that Black students are less likely to graduate with STEM degrees compared to White and Latino students (Tsui, 2007). However, data shows that Black students start their higher education career in a STEM course at rates similar to White and Latino students, yet they change their major or do not persist to graduation (Riegle-Crumb et al., 2019; Sithole et al., 2017).

Punitive Institutional Policies

A third large bone of the causal analysis diagram highlights institutional policies as a factor in low success rates for Black students in STEM programs. While race and class are issues in the post-secondary education system, there is a need for policy shifts to support the success of all post-secondary students and for justice-conscious policy making to promote equity (Baker, 2021). The systemic issues facing Black students in STEM were created by public and institutional policy and must be addressed in the same way.

In the current system of four-year institutions, if a student fails any single course in any typical course term, their chance of receiving a degree is cut in half, and not being enrolled full-

time may reduce and jeopardize financial aid funding, which is often utilized by and necessary for Black students to fund their post-secondary education (Adelman, 2006). All these contributing factors are present for students attending institutions where the minimum number of credits to graduate is 60 at a two-year institution and 120 at a four-year institution. To receive those credits, the student takes courses to satisfy the requirements for the institution and their specific major (Capper, 2019; Hrabowski, 2018; Van Dusen & Nissen, 2020).

Theoretical Framework

Our theoretical framework draws upon Pierre Bourdieu's 1977 theory of social reproduction, which argues that capital forms the foundation of social life and dictates one's position within the social order. Specifically, Bourdieu's concept of cultural capital refers to the collection of skills, material belongings (i.e. clothes, cars, housing), and credentials that one gains by being part of a particular social class. Cultural capital is often expressed in group settings through shared or mutual interests, thus creating a collective identity. For example, "you are one of us." Importantly, Bourdieu highlights that cultural capital is a major source of social inequity. Certain forms of cultural capital are valued over others and can hinder one's sense of belonging and social mobility (Bourdieu, 1977).

In relation to this study, the ability to attend college is strongly linked to retaining and reinforcing the current social power and class structure by creating a hierarchy of those that can and cannot access and succeed in higher education. Bourdieu's theory of Reproduction submits a model that current power structures are kept in place by social reproductions that work "against the will" of school agents to "stamp pre-existing differences in inherited cultural capital," and the "school helps make and to impose the legitimate exclusions and inclusions which form the basis of the social order" (Bourdieu & Passeron, 1970/1990, pp. viiii-x). This hierarchy is created

through a myth of meritocracy and an assumption that all students have the same social and economic resources to prepare for post-secondary education (Loza, 2003). Students that are not part of the dominant culture (i.e. Black students) experience a lack of belonging in STEM fields and, instead of mentoring, a feeling that faculty interactions are meant to weed them out of the STEM disciplines (McCoy et. al., 2017). The social hierarchy, negative faculty interactions, and curricular bias is reflected in higher education and leads to discrimination against individuals from lower income families and People of Color in educational settings, further perpetuating oppression (Serna & Woulfe, 2017). Even controlling for academic preparation, researchers find that introductory STEM courses disproportionately drive out minoritized students and perpetuate disparities in STEM field representation of successful students and faculty (Hatfield et al., 2022). Consequently, Bourdieu's concept of cultural capital provides a theoretical lens for us to examine the power dynamics and underlying assumptions that perpetuate marginalization of Black students in STEM fields.

Throughout the paper, we will refer to Bourdieu's social and cultural reproduction theory and highlight some of the tenet's that relate to themes found in this research and today's culture. In the preface to his 1990 edition of *Reproduction in Education, Society and Culture*, Bourdieu states that:

[The Theory's] advocates and adversaries alike have frequently joined in reducing an involved analysis of the extremely sophisticated mechanisms by which the school system *contributes* to reproducing the structure of the distribution of cultural capital and, through it, the social structure (and this, only to the extent to which this relational structure itself, as a system of positional differences and distances, depends upon this distribution) to the

ahistorical view that society reproduces itself mechanically. (Bourdieu & Passeron, 1970/1990, p. vii)

The terms that will most frequently be seen align with Bourdieu's concepts of Habitus, Power, Field, and Capital. We will briefly define these terms for later use:

Habitus: According to Bourdieu habitus is "the product of internalization of the principles of a cultural arbitrary capable of perpetuating itself after [Pedagogic Action] has ceased and thereby of perpetuating in practices the principles of the internalized arbitrary" (p. 31).

Power:

Insofar as it is an arbitrary power to impose which, by the mere fact of being misrecognized as such, is objectively recognized as a legitimate authority, Pedagogic Authority, a power to exert symbolic violence which manifests itself in the form of a right to impose legitimately, reinforces the arbitrary power which establishes it and which it conceals. (Bourdieu & Passeron, 1970/1990, p. 13)

Field: Field is a term that "never totally excludes dependence on power relations." (p. 19), and to which "the extent to which the pedagogic and, a fortiori, intellectual practices ... of a category of agents obey the law of 'routinization' varies directly with the extent to which this category is defined by its position in the Educational System" (p. 60). In terms of our research, *field* provides the concept of different social areas of life, e.g. academics, politics, work, that while appearing independent, are interconnected and have their own power structures. Our focus is the different systems in higher education.

And Capital:

In any given social formation, the system of Pedagogic Actions, insofar as it is subject to the effect of domination by the dominant Pedagogic Action, tends to reproduce, both in

the dominant and in the dominated classes, misrecognition of the truth of the legitimate culture as the dominant cultural arbitrary, whose reproduction contributes towards reproducing the power relations. (p. 31)

Bourdieu's capital includes skills, material belongings, credentials, and social class. In the education sphere, it helps faculty, students, and staff point to each other and say - "you are one of us." Here, Bourdieu highlights how education systems influence and reproduce the dominant culture. The education system misunderstands their role in being influenced — they are under the influence and present the dominant class values as the "truth" to their students. This misrecognition perpetuates existing power structures within society by indoctrinating students into accepting these values as inherently legitimate and desirable, thus reinforcing and self-perpetuating the social status quo even when attempting to disrupt it. In addition to the perpetuation of the dominant culture (class), the definition of capital extends from class to culture.

The Pedagogic Action whose arbitrary power to impose a cultural arbitrary rests in the last analysis on the power relations between the groups or classes making up the social formation in which is carried on contributes, by reproduction the cultural arbitrary which it inculcates towards reproducing the power relations which are the basis of its power of arbitrary imposition (the social reproduction function of cultural reproduction). (p. 10)

With these definitions shared, the theoretical framework being used will be aligned with the themes shared throughout the data discussion later in the paper. Bourdieu's theory brings the necessary context for a deeper understanding that the ability to attend college is strongly linked to retaining and reinforcing the current social power and class structure by creating a hierarchy of those who can and cannot access and succeed in higher education. This hierarchy is created

through a myth of meritocracy and an assumption that all students have the same social and economic resources to prepare for post-secondary education (Loza, 2003). Students who are not part of the dominant culture (i.e. Black students) experience a lack of belonging in STEM fields and, instead of mentoring, a feeling that faculty interactions are meant to weed them out of the STEM disciplines (McCoy et. al., 2017). The social hierarchy, negative faculty interactions, and curricular bias are reflected in higher education and lead to discrimination against individuals from lower income families and People of Color in educational settings, further perpetuating oppression (Serna & Woulfe, 2017).

Professional Roles and Positionality of Scholar-Practitioners

Before proceeding more into the paper, we want to acknowledge where we as authors are positioned to discuss and research these issues through our positionality statements. A positionality statement is an essential component of a research paper that helps to provide transparency about the researcher's background and potential biases. It is a statement acknowledging the researcher's subjective position, experiences, and beliefs that might have influenced the research process and the interpretation of the findings. A positionality statement aims to help readers evaluate the researcher's perspective and the possible impact it might have had on the research (Milner, 2007). In the following sections, we each provide an overview of positionality related to our proposed study.

Brandy Bowman

I am a 47-year-old White, cis-gendered, heterosexual female. I am the native of a small rural Southern Appalachian town in Western North Carolina and a first-generation college graduate. My family of origin was working class and lived in poverty. My lived experience of growing up in poverty provides me with awareness and understanding of how poverty impacts

educational attainment, success, and access to educational resources. Higher education was built on White middle-class cultural norms. Students with different backgrounds have difficulty navigating and succeeding in that system because it was never intended for them to succeed. Through the assistance of need-based Pell Grants and student loans, I was able to obtain a bachelor's degree in psychology and a master's degree in macro social work. My lived experiences have steered and informed my professional ambitions positionally that have allowed me to address the needs of children and families impacted by poverty and structural racism, and to higher education and public K-12 education with focus on educational disparities created by issues of race, poverty, and social class.

My scholar-practitioner work required for this improvement initiative will require me to work with higher education faculty and staff and will create a dynamic of placing me in a position of leadership. My professional experiences place me as a perceived insider because I have first-hand and academic understanding of the many institutional complexities of higher education. The power dynamics created by higher education's organizational structure and the practice of tenure place staff in perceived and objectively places staff with little to no power. However, I am not currently employed in higher education and was previously a staff member. Thus, I will navigate this study as both a perceived insider and outsider.

Robert Rodier

As a 53-year-old White, cis-gendered, non-disabled man with a master's degree and an upper-middle-class family income, I am aware that my positionality will affect my perceptions and influence the research process and the interpretation of the findings. My education, social, and economic status contributes to my worldview, and my experiences might not be representative of those from different backgrounds. Therefore, I will approach my research with

an open mind and acknowledge my potential biases. I understand that the influence of these factors on participants' experiences and perspectives is crucial to comprehend and analyze adequately. As a researcher, I am aware of my own interests and agendas and will negotiate and balance them with those of the participants. Additionally, I acknowledge the social, political, and contextual nuances and realities that have shaped the participants' ways of knowing, both past and present. I will consider these factors while collecting and analyzing data, reflecting on the work, and presenting my findings. Ultimately, my goal is to conduct research that is inclusive, equitable, and respectful to all participants involved.

To perform practitioner-scholar work, I will partner with institutions through my employer, the Gardner Institute. I am not a faculty member nor employed at the institution doing the improvement initiative, so I will be in an outsider position. Along with my social identity, my experiences through student and staff roles in higher education may create biases towards faculty. Furthermore, my lack of experience as a faculty member may affect my relationships with improvement teams. While I eventually became successful in higher education, my experience as an undergraduate student may bias me against undergraduate faculty. To counter this bias, I have worked with many talented and student-centered faculty during my time working on a master's degree and with the Gardner Institute, so I know that my experiences as an undergraduate student do not have to be the normal experience. Throughout the improvement process, I will continue to reflect on my learning and discussions with the other participants in this process.

Local Context: The Gardner Institute

Because neither author was employed at an institution of higher education at the time of this improvement initiative, the choice was made to partner with Robert Rodier's employer, the John N. Gardner Institute for Excellence in Undergraduate Education, or the Gardner Institute.

The Gardner Institute is a small, 22-year-old, non-profit organization that started with rented space on the Brevard College campus. Currently, it is mostly located in North Carolina, but over 50% of its staff work remotely from other areas of the United States. The mission statement is to [partner] with colleges, universities, philanthropic organizations, educators, and other entities to increase institutional responsibility for improving outcomes associated with teaching, learning, retention, and completion. Through its efforts, the Institute will strive to advance higher education's larger goal of achieving equity and social justice.”

(Gardner Institute, n.d.)

The Gardner Institute's focus is to create change in higher education with a suite of initiatives meant to provide administration, staff, and faculty with opportunities to examine the complex structures at their institutions. These initiatives focus on specific areas of higher education that improve student success such as the first-year, transfer, advising, course transformation, and teaching and learning. To implement this improvement initiative the authors partnered with the Gardner Institute's Curricular Analytics Community (CAC) initiative whose goal is to increase equitable higher education success metrics, through efforts to help an institution analyze selected curricula through the use of improvement science tools and an open-source analytics tool.

Improvement Initiative Design

Improvement science provided the methodological framework for implementing this change initiative. Our research project centered on developing an equity-focused professional development training program centered on the importance of disaggregating data (Langley et al., 2009). This program aimed to shed light on the disproportionately low success rates of Black

students in STEM, both in higher education and the occupational workforce, using disaggregated data and national statistics. By adopting an equity lens, our goal was to enhance the ability of faculty and staff to recognize and address how complex curricula contribute to equity gaps, particularly affecting Black students. This improvement seeks emphasizing systemic improvements rather than attributing student success deficits to the students themselves. The details of this equity-focused learning module are documented in Appendix B, providing a structured path to better support faculty and staff in making meaningful changes to promote equity within education.

Theory of Improvement

Many interventions and programs have tried to address the student success initiatives between Black and White students in higher education STEM programs (Loza, 2003). Those efforts include student advising, faculty professional development, STEM-focused articulation agreements, policy and practices areas (Grote et al., 2020). While institutions have struggled scaling the implementation of good practices to support students, institutions and researchers also use language that places blame on the student for factors that affect their success such as race, ethnicity, and socio-economic status. These practices are decades out of date with the literature. If an institution accepts a student, they share a responsibility in resources to ensure that student succeeds in obtaining their degree (Tinto, 2012).

In order to address these issues, institutions must recognize they bring their environmental factors to bear on students and influence their degree attainment (Baker, 2021). Calculus, as an example, serves as a prerequisite for many STEM programs. Students who attended high schools without access to pre-calculus will need to take this course as part of their college coursework before starting their STEM program. The lack of access to prerequisite

courses in high school prolongs the time to degree completion. Prolonged degree completion adds to the financial costs and jeopardizes need-based aid. Compounding the negative effects of adding courses to the student's degree plan, first term STEM courses, like calculus, often have high rates of non-passing grades such as D, F, W (withdrawals), and I (incomplete) (DFWI). In these cases, students are required to repeat courses and delay progress in the program. If institutions assume a role and responsibility for student success when they matriculate a student, they must examine the barriers that create these problems (Stewart et al., 2015). This study shifted the focus from blaming individuals to examining the systems of post-secondary institutions, ensuring that students can succeed in curricular programs regardless of their prior experiences. As Komenda et al. state, “[n]o universal solution, based on an approved pedagogical approach, exists to parametrically describe, effectively manage, and clearly visualize a higher education’s curriculum, including tools for unveiling relationships inside curricular datasets (2015, p. 1).” This is because degree program designs are often unnecessarily complicated.

Therefore, our focus on faculty and staff’s understanding that curricular complexity and program design create inequitable outcomes for Black students remained important. Our aim was to increase faculty participants’ understanding of equity in relation to complex curriculum to provide greater access to Black students in STEM fields. Our theory of improvement held that participation in equity-focused professional development sessions would increase participants’ capacity to understand that curriculum complexity inhibits student success and creates inequitable outcomes by disproportionality affecting Black student populations.

In order to change the behaviors and outcomes associated with social identity – say too few Black graduates in STEM – institutions should not focus on changing the internal identity of

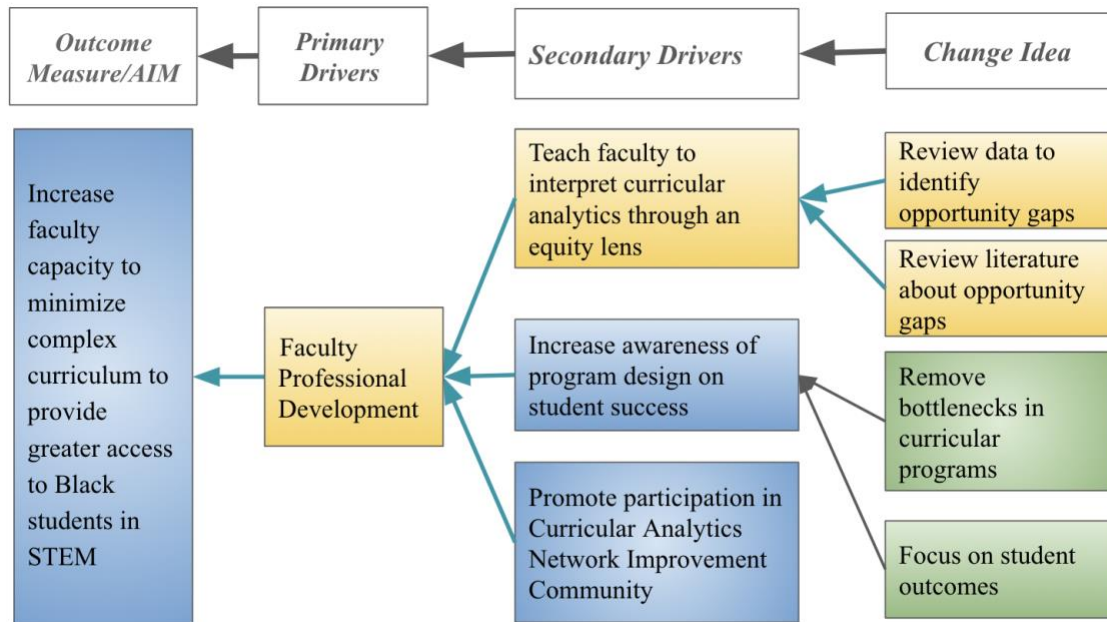
a student [e.g., with a program for each identity]. Instead of changing the student, institutions must consider how its program of curricula can adapt to the student. To address the issue of too few Black graduates in STEM fields, our approach did not aim to change students' internal identities through programs for each identity. Instead, we explored how the institution and its curriculum can be modified to better support and adapt to the needs of the students. This principle formed the basis of our theory of improvement.

Defining Project Levers for Change

The driver diagram shown in Figure 2 below helped us visualize and illustrate our theory of improvement and provided a structured approach as we implemented our improvement initiative. Through our literature review and planning process, we identified a course of action in the Driver model. The selected driver is to provide faculty development through participation in an equity-focused module to achieve the change of increasing awareness of equity issues in program design on student success through streamlining complex curricula where possible. The goal is to improve access and success for Black students in STEM through focused professional development and the use of curricular analytics.

Figure 2

*Driver Diagram*⁵



Improvement science utilizes driver diagrams as a tool for project teams to identify and organize the key factors that contribute to achieving a specific outcome and a theory of improvement; it focuses the improvement effort after a causal analysis occurs. The driver diagram in Figure 2, ensured our team had a shared understanding of what we aimed to achieve and what levers of change we would use to get there. In the first step we identified a measurable improvement. Then we identified the primary drivers – these were the team’s areas of focus to achieve the intended measurable improvement. Because the primary drivers are usually a large

⁵ The yellow boxes outline the areas focused on by the work described in this disquisition. The green boxes highlight the change ideas of the larger CAC NIC.

system, the driver diagram required the improvement team to identify secondary drivers and identify subsystems, to be targeted for change.

The improvement science driver diagram provided a structured approach to achieve the aim of the project, and ensured the team had a map that outlined the theory of improvement. The driver diagram in Figure 2 below illustrates our theory of improvement. The improvement initiative aims to increase faculty capacity to minimize complex curricula to provide greater student access. We list primary and secondary drivers in the driver diagram as areas of the system to apply efforts to achieve the improvement aim (Bryk et al., 2017; Hinnant-Crawford, 2020).

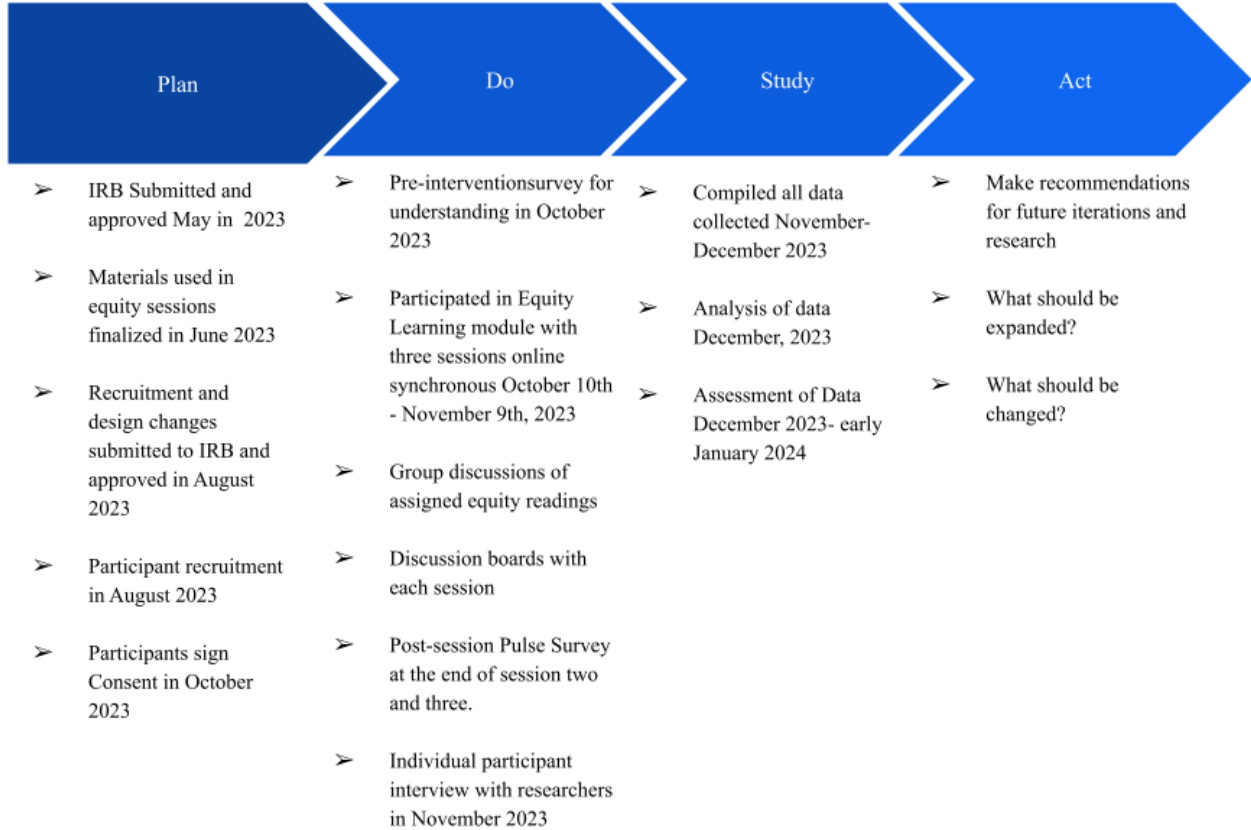
Plan, Do, Study, Act (PDSA) Cycle

Our intervention only consisted of one Plan, Do, Study, Act (PDSA) cycle beginning in October 2023 and ending in January 2024. Using improvement science as our method of inquiry, the PDSA cycle provides a method of continuous improvement to test change ideas and iterate into next cycles. The cycles are meant to be short, time-bound, pragmatic scientific experiments that test a hypothesis in a complex system (Carnegie Foundation, 2022).

The aim of our improvement initiative was to increase faculty capacity by engaging in equity-centered professional development to learn and understand that curriculum complexity creates inequitable outcomes for Black students. In Figure 3 below, we provide a high-level outline of our PDSA timeline. Dates for meetings, surveys and interviews can be found in Appendix L.

Figure 3

Intervention Timeline



Plan

During the Plan phase, the intervention plan and timing were informed by the researchers and members of the design team. Anchored in improvement science methodology, our improvement intervention used formative metrics to determine the effectiveness of each cycle and gauge the success of the larger project including outcome measures, driver measures, process measures, and balancing measures discussed in the upcoming improvement science measures section. The summative evaluation consisted of one-on-one interviews and pre-equity

session participation survey responses to determine if the introduction and use of an equity lens to discussions about curriculum and program design resulted in a change in outcome measures for the participants. The survey can be found in Appendix F. We also added one-on-one surveys to provide additional measure data.

After the data was collected from our formative measures, we collected the summative data to analyze and measure the difference between participants' understanding that course complexity and program design create inequitable outcomes for Black students and other non-traditional student populations before and after they participated in the equity module. To measure these differences, we administered a survey prior to participation and administered the same survey upon their completion of the equity module. The qualitative review of feedback about the equity module process and the perceived effectiveness of various aspects of the equity training components were key to our evaluation of the initiative and measuring if a change occurred. The summative and formative evaluations informed our analysis and recommendations for future iterations of PDSA cycles.

Design Team

An important aspect of our improvement science work was the inclusion of those who know the system where the change effort will occur (Hinnant-Crawford, 2020). The improvement science framework required the creation of a design team made up of local faculty and other content experts, including the scholar-practitioner authors. Collaboration between scholar-practitioners and institutional stakeholders makes up the design team of this improvement initiative.

Our design team included two staff members at Gardner Institute, Stephanie Foote, Ph.D. and Brandon Smith, Ed.D. The Gardner Institute design team members were chosen for their

understanding of the problem of practice and their expertise of curricular complexity and program design in higher education. Stephanie Foote, Ph.D. is the Vice President for Teaching, Learning, and Evidence-Based Practices at Gardner Institute. Foote earned her Ph.D. from the University of South Carolina in Educational Administration-Higher Education. Brandon Smith, Ed.D. serves as Associate Vice President with the Gardner Institute. Foote and Smith's role on the design team was to serve as a resource for the development and implementation of the improvement intervention.

Recruitment Methods

Having IRB approval, Drs. Foote and Smith sent an email to previous CAC participants announcing the opportunity to participate in an equity module and introduced our research project. We then 'replied all' to the email with additional information about the study and participation requirements to garner interest. We received interest from five individuals representing five different institutions. We proceeded by getting the necessary signed participation consent forms (Appendix D) for these five individuals and began our improvement initiative using the timeline found in Appendix L. Using qualitative data to allow for rich, open-ended responses provided a way to collect contextual information from the participants when responding to session readings, surveys, and discussion board prompts. The commitment and delivery window for the project changed from 12 to 5 weeks and the data collection was modified so there were five qualitative data sources.

Improvement Science Measures

As part of the planning for the intervention and improvement, key metrics and indicators were selected to help gauge our progress toward the improvement objectives and answer the questions in improvement science. There are four improvement science metrics: outcomes

measures, driver measures, process measures and balancing measures to help us determine if the improvement effort is effective at answering the following questions:

1. What problem is being solved?
2. How might this problem be addressed?
3. How will I know if a change is an improvement?

Outcome Measures

Outcome measures assist scholarly practitioners in comprehending the overall performance of the system and determining whether the changes they implemented are influencing the system at a broader level (Perry et al., 2020). The goal of our improvement initiative was to focus on faculty and staff’s understanding that curricular complexity and program design create inequitable outcomes for Black students remained important. Our aim was to increase faculty capacity to minimize complex curriculum to provide greater access to Black students in STEM. To measure if a change occurred, we compared the data collected from the pre- equity session survey and follow-up interviews as shared in Table 1. We used the outcome measures data to measure if a change occurred and to make recommendations for future PDSA cycles.

Table 1.

Outcome Measures

Type of Measure	Data Collected	Frequency	Data Collection Methods
Outcome	Pre-survey	2 times	<i>Qualitative</i> -Evaluative coding of pre-survey -Evaluative coding of session transcripts -Personal interview with all participants
	Individual Participant Interviews	1 time	

Driver Measures

The driver measures, listed in Table 2, were used to help determine how the intervention is affecting the program outcomes (Crow et al., 2019). Driver measures provide insight into the effectiveness of the implemented change in enhancing the system (Perry et al., 2020). Using the Qualtrics platform we created the post session pulse survey, which can be found in Appendix E. The post-session survey was administered at the end of the second and third equity sessions. The survey asked for feedback about the utility of the readings, a review of the assigned equity focus readings. Three discussion boards coincided with each equity session and served as an additional driver measure where participants anonymously responded to prompts crafted by the researchers for the assigned equity readings of that particular session, enhanced collaboration, and shared their knowledge and truths as each participant has experienced DEI and Black student success at their institution (Covelli, 2017; Yilmaz, 2008).

Table 2

Driver Measures

Type of Measure	Data Collected	Frequency	Data Collection Methods
Driver	Discussion board Qualtrics post-session pulse survey	Second and last (third) synchronous class	<i>Qualitative</i> Qualtrics 5-question survey, Appendix E Qualitative Review of Transcripts

Process Measures

Process measures are collected more frequently to identify if there are inconsistencies or irregularities in the process that are unexpected and are shown in Table 3. The intervention included several milestones during the intervention. We expected the milestones of attendance, discussion board participation, and individual interview to be completed by half of the participants. The process measures included the collection of data for the following questions:

1. Did participants attend the equity session?
2. Did participants attend the equity learning group discussions?
3. Did participants engage with the discussion boards?
4. Did participants provide an individual interview with the researchers?

Table 3.

Process Measures

Type of Measure	Data Collected	Frequency	Data Collection Methods
Process	Count faculty participating in each session Count responses in discussion boards tool Participation in individual interviews	Each synchronous class	<i>Quantitative</i> Transcripts Discussion board Transcripts

Balance Measures

Balancing measures helped to monitor and measure any possible unintended changes outside of our improvement initiative measurements (Bryk et al., 2017). We created a question

on the post-session pulse survey to understand if participation in this initiative has impacted their work outside of the equity module. We wanted to know if participants’ work outside of their participation changed or remained the same see Table 4.

Table 4.

Balance Measures

Type of Measure	Data Collected	Frequency	Data Collection Methods
Balance	<ul style="list-style-type: none"> Performance in work outside of the program remains the same for students and faculty 	Each synchronous class	<i>Qualitative</i> <ul style="list-style-type: none"> Qualtrics 5-question pulse survey, Appendix E Interviews, Appendix K

Do: Implementation & Data Collection

Recruitment Efforts

Following approval from Western Carolina University’s Institutional Review Board (IRB), we began our recruitment process. Our original plan was to recruit participants who were currently in a Gardner Institute’s Curricular Analysis Community (CAC) cohort. The CAC teaches participants how to use the curricula analytics tool for programs to create a visual map of course complexity and use program and student-level data to contextualize and examine student outcomes. These individuals were all higher educational professionals at various institutions across the country. Our proposed improvement design was to recruit CAC members and add our

equity designed module into the CAC's existing schedule over the course of 12 weeks.

Beginning in May through June 2023, we began participant recruitment by attending three online CAC sessions where we presented our research proposal and intervention plan to cohort and asked for participants. We then emailed each of those CAC participants with additional details and information about participation. Unfortunately, none of our efforts yielded interest from any CAC participant, so we pivoted our participant recruitment plan with guidance from our disquisition chair and design team. The recruitment email is Appendix H.

The design team met weekly for 45 minutes every Tuesday from April-November 2023 to support module refinement, brainstorm recruitment options, and provide input and feedback in preparation for online delivery of the intervention. Unable to recruit any participants in the first-round attempt, we changed the original participant pool from current to previous CAC participants. This shift allowed us to recruit participants that had previously used the curricular analytics tool and uploaded their program, student level data to examine curricular complexity at their institutions. This change in recruitment method meant we no longer needed to follow the 12-week CAC schedule. Our design team recommended we be mindful of participants' time and create three forty-five-minute sessions. Because of the reduced time spent in the group intervention, we added an additional qualitative data source in the form of one-on-one personal interviews with each participant. All other data measures and collection methods remained unchanged from our initial IRB approval.

After our IRB modifications were approved, the Gardner Institute sent an email to previous CAC participants announcing an opportunity to participate in an equity module. We received interest from five individuals from five different institutions. We proceeded by getting the necessary signed participant consent forms for these five individuals and began our

improvement initiative using the timeline found in Figure 3. The timing for the work changed as we adapted to a closing window to complete the work once the first group of CAC participants declined to participate in the research. While the plan changed from recruiting 6-8 institutions, we proceeded when there were five participants from five institutions. Using qualitative data to allow for rich, open-ended responses provided a way to collect contextual information from the participants when responding to session readings, surveys, and discussion board prompts. The commitment and delivery window for the project changed from 12 to five weeks. A descriptive table of the participants' demographics is outlined in Table 5.

Table 5

Participant Demographics

<i>Participants</i>	<i>Institution Type</i>	<i>State</i>	<i>Race /Identity</i>	<i>Gender Identity</i>	<i>Position Held</i>
Participant 1	University- 4 Year	OK	White	Female	Interim Associate Provost, Dean of Graduate Studies
Participant 2	Community College- 2 year	TX	White	Female	Director of Curriculum & Compliance
Participant 3	University- 4 Year	MI	White	Female	Director of Student Success
Participant 4	University- 4 Year	MD	White	Male	Assistant Vice President and Registrar

Participant 5	University- 4 Year	NC	White/Jewish	Male	Professor of Mathematics, Director of the Center for Jewish Studies
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Online Equity Module Curriculum

After participants signed all consent forms, we scheduled three dates to deliver our intervention. The online equity modules were built in the Gardner Institute’s learning management system and Western Carolina University’s Qualtrics platform. Along with the online learning platform, the information was shared with the participants using email to remove any access issues to the equity module. Each session’s readings and discussion questions were provided online and in the emails both before and after the session. Each session builds on information from the previous session as shared in Appendix B details. Session one was a broad introduction to Black student success in STEM fields and workforce implications. Session two centered discussions around implicit bias, structural racism, and minoritized student success in introductory courses. Session three provided information through discussion and a reading of case studies on how to use data to inform equity work in higher education. For all three sessions, the participants were asked to read short essays, research articles, and for session three, a book chapter to provide current context for the session’s topic. The session topics directly informed the themes identified and coded in the transcripts.

Throughout this process, we collected data to inform our improvement measures. Data was collected using five primary methods: 1) equity module workshops, 2) pre- equity session survey, 3) discussion boards, 4) pulse surveys, and 5) individual participant interviews. In the

following sections, we provide a brief description of the data collection process and align each method with our improvement science measure.

Equity Module Workshops

The equity module consisted of three training sessions aligned with the CAC meeting schedule. The researchers delivered the equity module content described above for approximately 45 minutes during the one-hour time block for each session. To our surprise, the participants wanted more time in the first two sessions than was initially planned. Prior to the delivery of content, we made time for the baseline pre-intervention survey. Each session was built with consideration for andragogy techniques for the adult participants (Henning, 2012; Knowles, 1988). For example, Knowles mentions four items or assumptions that adults require for learning: (1) they are “self-directed;” (2) they want experiences to serve as resources; (3) they can relate the information to their roles; and (4) they can apply their learning immediately (Knowles, 1988, pp 5). We incorporated space for the participants to share their experiences in each session. The session’s topics were framed so that the participants understood how the content related to Black student success in higher education, provided multiple modalities for participant sharing of their experience and professional knowledge, and discussion time to address items two through four of Knowles’ andragogy assumptions. The discussions provided both an opportunity for the participants to share their experience and to ask questions from their colleagues (Henning, 2012). We could not control for participant desire for self-directed learning directly, but since the participants self-selected into the intervention study, we made the assumption that they wanted to learn more about how equity and curricular analytics could be coupled. This assumption covers Knowles’ self-directed learning assumption.

Time was made in during each equity module workshop for data collection. Each session was recorded and served as a process measure of evaluation. Quantitative data was collected on participant attendance at the sessions to support the improvement science process measure. The session time was also used for almost all the other qualitative data collection so that our captive audience had time to spend in completing surveys or discussion boards. The three sessions were recorded and later transcribed for data analysis and inductive coding. To make the information as easy as possible to access for the participants, each class was preceded and followed by informative emails found in Appendix G.

Data Collection: Curriculum Scaffolding

Session one focused on the broader view of student demographic changes and how those emerge at each institution and STEM program. Session two focused on implicit bias, structural racism, and student success of minority populations in STEM gateway courses. Finally, the third session provided mini-case studies on how to use data to address and advance equity at an institution. For all three sessions, the participants were asked to read short essays or research articles to provide current context for the session's topic. The topic for each session informed the themes found and coded in the transcripts.

Pre- Equity Session Survey

A pre-survey was administered during the first workshop before content was delivered. The pre-survey questions are included in Appendix F. We intended to use pre- and post-surveys as an outcome measure, and we administered both surveys. However, we had 100% participation in the pre-survey and only two completions of the post-survey. The post-survey was linked during the last class session, but in an attempt to maximize learning and discussion time between the participants, time in the session was not provided to complete the survey. The initial

survey took close to 20 minutes to administer and complete by the participants, and that time was used for discussion in the last session. The post-improvement survey was requested at the end of the third session. Pre- and post-improvement surveys were intended to provide data for the initiative's improvement science outcome measures. Due to the lack of responses of the post-survey, we decided to discontinue use of the post-survey as an outcome measure for this study. We decided to keep the rich qualitative data the participants provided in the open-ended questions of the pre-survey for our qualitative analysis.

Discussion Boards

With the intervention's shift to three classes and 45-minute class time, we added discussion boards to coincide with each session. These were to increase participant engagement and learning as well as provide additional data for the research and to inform an improvement science driver measure. During each equity module workshop, we provided time for the participants to respond to reading discussion prompts on the discussion boards. Each discussion board was pre-populated with the previously shared discussion questions. See Appendix M for details. We opted to keep the discussion board posts anonymous to allow for more candid responses. The discussion boards allowed the participants to build a sense of community, enhance collaboration, and share their knowledge and truths as each participant has experienced DEI and Black student success at their institution (Covelli, 2017; Yilmaz, 2008). The three discussion boards were used as a qualitative data collection method and a process measure to determine if the equity sessions achieved the equity awareness that was intended. The responses can be found in Appendix M.

Pulse Surveys

At the conclusion of the second and third workshop, we provided links to a post-session pulse survey using Qualtrics. The purpose of the pulse survey was to determine how the intervention was affecting the program outcomes. The participants were asked to complete a survey after each of the synchronous courses. Each pulse survey took approximately three minutes for the participants to complete, and we retained a 100% participation rate. We administered pulse surveys after the second and third equity workshops. The pulse surveys served as balance measure to assess unintended changes, specifically, that participants' performance work outside of the program remained the same for students and faculty. The survey is found in Appendix E.

Individual Participant Interviews

The one-on-one participant interviews were added after the original proposed intervention timeline was modified to three equity workshops. We opted to add individual participant interviews to maintain the integrity of the learning process and to gather rich qualitative data about how participants might integrate the equity modules into their practice. The purpose of the interviews was to capture qualitative data to serve as an outcome measure of our overall intervention. The shift in our recruitment methods allowed us to recruit participants that had used the curricular analytics tool to upload their program and used student level data to examine curricular complexity at their institutions.

To accomplish this, we posted a calendar link during the third workshop and asked participants to sign up for a one-hour interview with us. Four of the five participants signed up for an interview. Each interview followed a semi-structured interview approach with a set of questions outlined in Appendix K. The first five questions focused on what the participant had

learned and took away from the equity workshops to apply in their curricular work. Each participant was asked the same set of questions, and the researchers took notes for each of the participants' answers. A transcript was created for each interview from the Zoom recording using Otter.ai tool, and the data was analyzed and coded using qualitative thematic analysis as described in the following section.

Study

In the improvement science framework, the Study section is where the data analysis occurs. In this section, we analyze the data, reflect and consider what went as predicted, and formulate learnings from the research by sharing major themes that will be discussed in the Act section (Hinnant-Crawford, 2020; Perry et al., 2020). While there was a desire to use a mixed-methods approach to collecting data, the quantitative collection was minimized when the participant group was finalized with five participants. Therefore, we expanded qualitative data collection by adding individual participant interviews. We did not focus on any particular institutional staff type during the recruitment process. We wanted to recruit participants that already understood the CAC process and were interested in the structure of curriculum, the structural and cultural issues that influence constraints some faculty and staff impose on program designs, and a willingness to assess the CAC and curricular complexity work with a lens primed by the equity module readings and discussions.

Qualitative Analysis Process

We conducted qualitative inquiry and thematic analysis using a six-step strategy outlined by Creswell (2003). Each of the equity module workshops and participant interviews were recorded on Zoom, an online meeting platform, and then transcribed using Otter.ai, an online

service. The pre-survey and pulse surveys were collected using the Qualtrics online survey platform. The discussion boards were hosted online by the Padlet.com service. Creswell's (2003) process of qualitative analysis is summarized in the following six steps: 1) Preparing data, 2) Reading for general understanding, 3) Coding, 4) Describing and creating themes, 5) Representing, and 6) Interpreting. Using Creswell's framework for qualitative analysis, we worked through each of the data sets individually and then collectively: interviews, surveys, discussion boards, and class discussions. Below we describe in more detail each phase of the process.

Preparing data

In the first step, we prepared the data for review by organizing the transcriptions or moving it into a Word document when it was a survey that was downloaded as a spreadsheet. Because we had so many data sets, it was necessary to take the time to make it easy to read through, and also organize it so we could keep track of the data through the qualitative analysis process (Creswell, 2003). We used a shared Google drive with folders for each data set to keep ourselves organized throughout this process. We administered four Qualtrics surveys and recorded close to seven hours of Zoom sessions from the equity workshops and interviews that needed to be transcribed. We used the Otter.ai transcription service to transcribe Zoom recordings into Word documents. After the data was organized and streamlined, we could begin the next step in the process of identifying general understanding.

Reading for general understanding

As the second step in Creswell's (2003) framework, we read through all the material to get a general understanding of all the data being collected across different methods. We met twice a week to discuss, plan, and lead each equity workshop. These discussions allowed us to

talk through ideas and add to previous notes from the in-person sessions. We reviewed all data to gain a broad understanding of what was in it. During our discussions, we began making sense of the data and reviewed the tone of the conversations and impressions from each equity workshop (Creswell, 2003).

Coding

The third step in the qualitative analysis process is to begin independently analyzing the data and organizing it. The method used to analyze and organize the data was a coding process. The act of coding is “taking data and labeling them as categories with a term, often based on actual participant language” (Creswell, 2003, p. 192). Brandy and Rob each reviewed their copies of the data and then saved them back to the shared Google drive for shared review in step three. Each of us created more than a dozen codes to help with the analysis and coding of the data sets. Along with the coding, we began to add to our general understanding of the participants’ understanding of diversity, equity, and inclusion in their individual professional and collective contexts. Ultimately, we identified 58 unique codes that spanned all five data sets (Appendix O). The coding process was a collaborative and iterative effort that informed our overarching themes and findings of our study.

Describing and Creating Themes

After the initial steps of organizing and reviewing the data, step four included another discussion. We discussed our ideas about the review of the data considering our notes and coding. Out of those discussions, we decided on the categories of the codes that we created (Creswell, 2003). We discussed connections between session content, data sets, and participants. We looked at our codes and reviewed the causal analysis section (Figure 1) for congruency. We used the literature around student success for Black students in STEM and the causal analysis to

group the codes into themes. This process was led by participant quotes, but we also were influenced by the literature review and our participation in the process. In the discussion about the categories during this step of the process, we focused on three meta-themes as the biggest issues that were shared by all of the participants (Maxwell, 2013). These themes included:

1. Bias
2. Anti-Diversity, Equity, and Inclusion (DEI)
3. Institutional culture

Representing

We round out the Study section with details from the fifth step of Creswell's framework. Here, we discuss the findings from each data set and how they represent the participants (Creswell, 2003). We created thematic tables for the data sets that are available in the appendices to show the multitude of codes that influenced the thematic decisions. The thematic tables can be found in Appendix I for the pulse surveys, Appendix J for the pre-/-survey, and Appendix N for the session and interviews.

Interpreting

In the final step, we begin to provide a discussion and interpretation of the data as well as lessons learned and possible next steps for research (Creswell, 2003). This step is the Act section of this disquisition and described in the following sections.

Findings and Analysis

We now share the findings of our study using the four primary improvement science measures: outcome, driver, balance, and process. These four measures help us determine if the improvement effort was effective at increasing participants' capacity to understand the connections between curriculum complexity and equitable outcomes for Black students in STEM

fields. We focus our analysis on the growth and development of the participants' equity-mindedness in relation to their institutional role. To deepen our analysis, we followed Creswell's (2003) qualitative analysis process described previously to understand the experiences of our participants. Appendix N provides thematic analysis tables created for the data. In Appendix O, we provide a table aligning the 58 codes with the three meta-themes: bias, anti-DEI, and institutional culture.

Outcome Measures

We utilized two data sets to assess our outcome measures: 1) pre- survey and 2) individual participant interviews. Because of the richness of the participant interview data, we chose to highlight these findings in detail in the Discussion section below instead of in this section. It is important to note that, based on the pre-survey data, participants entered this study with a baseline awareness and knowledge of diversity, equity, and inclusion in higher education. This study recruited from a pool of previous participants of the Gardner Institute's Curricular Analytics Community (CAC), and their past participation in the CAC and self-selection to participate in this equity-focused research project indicates that they may have had a higher level of awareness of student success issues related to equity within curricular design. This predisposition may have influenced our findings, as the participants may be more receptive to concepts around increasing student success in STEM for Black students. Furthermore, it is important to note that only two out of five participants responded to the post-survey. This low response rate was not optimal, but the pre-survey and individual participant interviews allowed us to gain deeper insight into our outcome measure. In the following section, we analyze the pre-survey data.

Our analysis of the pre-survey data showed that participants perceived their positionality as part of the institution and with limited influence over the outcomes of their efforts within the larger system of the institution. In the pre-survey, institutional culture was identified by all participants. Some, such as participant four, stated that, “I think it is important culturally for us to be a successful nation,” while other participants discussed aspects of institutional culture that affected students feeling included or supported at the intuition. Each participant acknowledged the importance of the diversity of students and was able to distinguish between equality and equity. For example, participant 2 mentioned how, “[I]t is essential to build a supportive and inclusive culture around the curriculum that is equitable and accessible for all.” This participant acknowledges an important distinction between being equitable and equal by stating clearly that programs require a culture that also makes the programs accessible, inclusive, and supportive. Furthermore, participants stated their understanding of the importance and necessity of cultural inclusivity and accessibility for students. However, when asked how much control they have on diversity in their programs each of the five participants stated they have no control. When asked how much ownership they have in the decision-making process about program course offerings, participant 3 stated, “I would say no control. All undergraduates are eligible to participate with the programs I oversee, but they are student success programs, not departmental major programs.”

In assessing the outcome data, we found that participants responded to equity and student success questions with a more personal lens. The responses included more “I”s in their responses about the importance of diversity in their individual, departmental, and institutional spheres of influence. Furthermore, the data revealed a notable progression from recognizing institutional aspirations for diversity to actively pursuing specific efforts to enhance diversity, equity, and

inclusion. For example, responses shifted from broad discussion in the pre-survey to concrete in the interviews. In the pre-survey, one participant said they want the university to be a place “where every student feels a sense of belonging in the program.” Later, the same participant responded that they are “advocating to build a school district to institution pipeline and make it a priority. Because most of our school district pupils are Black and Brown, I see this as a way to create stronger ties to the local community and improve the campus.” This shift in mindset suggests a move from a theoretical understanding of DEI’s importance at the institutional level to a more pragmatic and targeted approach at the program level. The shift may be due to our equity module intervention and discussions that highlight population shifts (which they acknowledge in the discussions), bias, or looking at their respective data. This evolution aligns with Bourdieu’s (1977) cultural reproduction theory, as it demonstrates an idea to disrupt the traditional cultural norms and power structures perpetuated within educational institutions, moving towards a more equitable and inclusive academic environment.

Driver Measures

We utilized our driver measures to identify short-term benchmarks to understand how the intervention is affecting the outcome measures and the intervention findings. The post-workshop pulse survey and discussion boards were the driver measures identified for this study. The data collected from the pulse surveys and discussion boards were rich with participants’ comments and reflect that the participants were engaged in the equity readings and workshops and have a commitment to addressing inequitable student outcomes at their institutions. The discussion board writing prompts allowed us to determine if the participants were engaging with the equity readings and literature. We utilized the pulse surveys and the discussion boards as short benchmarks to determine the level of engagement of participants’ during the professional

development equity workshops. Using these as driver measures, we analyzed the data captured in these two data sets.

Our findings indicate that the participants understood the equity information shared in the readings and discussions. For example, we observed participants' understanding and engagement of the equity readings as reflected in the following anonymous discussion board comment:

Students arrive at our campus and are advised on their classes by a small staff, not faculty. It may be that their bias [staff advisor] is guiding initial courses. For example, without an appropriate math course in the first year, it may be that certain STEM pathways are closed. That is just three staff members - so a bias there propagates.

Because of this comment we knew our intervention was on track to meet our outcome measure. Specifically, this comment demonstrates a layered understanding of how bias affects student advising. Additional discussion board comments aligned with the three meta-themes (bias, anti-DEI, institutional culture) identified using qualitative analysis processes.

Balance Measure

The improvement science methodology employs balance measures to gauge if altering one aspect in a system creates unintended disruption to another segment of the system (Hinnant-Crawford, 2020). We utilized the pulse surveys at the end of each equity workshop as our balance measure to detect any changes created by participation in this improvement initiative. An important component of the balance measure is to understand if participation in the equity workshops had a negative impact on participants' professional duties. To that end, we chose to track if participants' work performance outside of the program remained the same for students and faculty as the balance measurement. After the second equity workshop, we administered a pulse survey. This survey included the open-ended question, "Is this work impacting your work

outside of the equity modules?” to track the impact experienced by participants. We received a unanimous response that this module had “a positive impact.” Our assessment is that the intervention and equity workshop content did not create a negative impact on participants' professional work duties.

Process Measure

To ensure there were no unexpected inconsistencies or irregularities during our intervention, we used run sheets to track participant attendance at the equity workshops and engagement in the discussion boards and individual interviews. The participation rate for each run sheet was 80% or higher, which indicates a high level of participant participation and engagement throughout the intervention. Below is a breakdown of the frequency and participation rate for each data set (Table 6.).

Table 6

Frequency and Participation Rate in Data Sets

Data Set	Frequency	Participation Rate
Attendance at equity workshops	15 of 15 (5 participants per workshop)	100% participation
Responses in discussion board Padlet	Padlet 1: 2/5 responses (4 prompt questions) Padlet 2: 5/5 responses (8 prompt questions) Padlet 3: 5/5 responses (3 prompt questions) (15 discussion questions total)	80% response rate
Participation in individual interviews	4 of 5	80% participation

Note. Each of the discussion boards had prompts pre-listed. They were the same pre-shared questions that were provided with each of the session module readings.

Discussion

We now discuss key findings from our participant interview data, as they relate to our outcome measure. As previously mentioned, we identified three meta-themes from our thematic analysis: 1) bias, 2) institutional culture, and 3) anti-diversity, equity, and inclusion (DEI). Our analysis reveals critical insight into the dynamics of equity efforts in higher education institutions. In the following sections, we describe these key findings in detail and discuss their alignment or misalignment with Bourdieu's (1977) theory of cultural reproduction. Specifically, we connect Bourdieu's concepts of habitus, capital, symbolic violence, and field with our three meta-themes.

Bias

When we began examining structural racism inherent in higher education STEM programs, we did a causal analysis (refer back to Figure 1) to understand the root causes of the inequitable outcomes for Black students in STEM programs. Faculty bias reflects some faculty members' beliefs that not all students can succeed as a causal factor that inhibits completion rates for Black students in STEM programs (Canning et al., 2019). STEM curricula use introductory courses to purposely "weed out" students. Participants identified bias and implicit bias throughout all dataset collections as a cause of inequity in student outcomes. Participants stated and understood that everyone has biases, particularly educators who fill in assumptions about how students got to the university. Several participants identified one strategy to help mitigate implicit biases as the imperative to talk to the students because, "We don't think like a student. We need their input because without it, we impose our own biased views and ideas" (Participant 3). Participants identified a specific example of implicit bias by college administrators for programs that result in high-paying jobs.

One participant shared that faculty are often pushed into supporting these programs. The participant shared that, “this is a pathway for [incarcerated students]; this may be their only pathway. They’re coming from [problematic] backgrounds or something of that nature.” This quote about a pathway for incarcerated students highlights faculty biases about programs and outcomes, particularly regarding wages. This particular example underscores Bourdieu’s concept of symbolic violence as it seeks to codify what success will look like for some students according to what some of the faculty think is possible. It preserves what faculty consider inevitable, but they do so by determining what is available to the student. Faculty determination of curricular pathways and complexity obfuscate the power they wield within the education structure and reinforce a dominant narrative that some people are worthy of a STEM degree and others are not. In effect, faculty decide who can benefit society by considering only the benefits that a student was provided at birth.

In Bourdieu’s theory of cultural reproduction, this symbolic violence, while short-lived, serves to perpetuate ideas of who can be taught certain disciplines and who can succeed in higher education. These actions by some faculty help perpetuate in themselves and their sphere of influence existing norms, biases, and discriminatory practices of who fits the idea of a particular degree and help further reinforce social hierarchies. Or, more succinctly, these actions reinforce Bourdieu’s habitus (Bourdieu & Passeron, 1970/1990), which is how the dominant culture’s education and other systems internalize inequitable principles long after education and other teaching have ceased and become the arbitrary norm of society (also defined under Theoretical Framework section). In the view of Bourdieu (1977), the education system is the internalization of social structures perpetuated by pedagogic authorities (education authorities), shaping the educated students they produce. The social reproduction of internalized classism becomes

evident when college administrators prioritize programs through a specific characteristic of the program, such as ensuring student earnings meet a predetermined threshold. The fact that the education authorities are carrying out requirements often set by external entities like legislatures or system boards reinforces habitus. Removing programs for lower-paying jobs may reflect the institutional habitus of prioritizing research, prestige, and the production of elite knowledge over vocational training or community-oriented programs. It can also marginalize individuals from less privileged backgrounds who may rely on these programs to access employment opportunities. This institutional habitus passed down from its governing system reinforces the broader societal norms and values perpetuating social inequalities.

Other participants look at bias from their context. Participant 5, a mathematics faculty member at a four-year institution, looked at bias in terms of the experts usually quoted and idolized in their discipline by sharing, “these famous mathematicians... they’re all White, European.” While this faculty member is aware that his discipline oftentimes centers White scholars, he recognizes that students bring different identities into the classroom. To support those differences, he brings non-White and European math experts into his classes to “bring different narratives” so that who a mathematician is opens up to show a more “complicated picture” (Participant 5). This example highlights the faculty member’s goal to bring in more diverse voices and representation from Scholars of Color to decenter whiteness in the curriculum. Another participant in Student Affairs shared a broader view of bias in education. They stated that it was not only their responsibility but their institution’s “moral obligation to provide students with what they need to acknowledge that [students] are not all starting at the same place for various and sundry reasons, and to give [students] what they need ...so that they can be successful (Participant 3).

The participants' perceptions align with academic research and findings that bias is part of what maintains structural racism in higher education STEM programs and perpetuates unfair outcomes spanning a lifetime to Black and other underrepresented students. Participant 2, a Director of Curriculum and Compliance at a two-year community college, expressed what was shared by the other participants in the discussions: the need to acknowledge differences in what students bring to their postsecondary careers. The social hierarchy, negative faculty interactions, and curricular bias are reflected in higher education and lead to discrimination against individuals from Black communities and lower-income families in educational settings and further perpetuate oppression (Chetty et al., 2018; Corneille et al., 2020; Serna & Woulfe, 2017; Tilsley, 2017). Whether it is educational preparation, life circumstances, lack of representation among Black faculty, or other factors that inhibit success, each participant stated that institutions should work with the students they accept to help them succeed.

Institutional Culture

The second theme that emerged from data analysis was institutional culture as evidenced by budgets, data use, and unstable leadership. The causal analysis we conducted early in this process (Figure 1) reflected that institutional culture through policies factor in low success rates for Black students in STEM programs (Adelman, 2006; Capper, 2019; Hrabowski, 2018; Van Dusen & Nissen, 2020). While our analysis of the interviews focuses on leadership issues, the more prominent theme of institutional culture aligns with Bourdieu's (1977) theory of cultural reproduction, specifically habitus and capital. Institutional habitus refers to an institution's collective culture and practices that shape its approach to education and social interactions. The tenet of capital, both social and institutional, affect issues like budget constraints, data utilization for decision making, and leadership stability (Bourdieu, 1977).

Higher education benefits from consistent leadership to provide stability in institutional efforts of trust and relationship building (Felten et al., 2016; Kezar & Eckel, 2002). Stability in leadership is helpful when the institution is affected by challenges such as changing environments of student demographics, community standards, or attempting to implement strategic changes. In this respect, higher education continues to face challenges related to the instability of institutional leadership, thus making equity decisions that require cultural shifts that are difficult to sustain. As with most systems, the higher education system, as with most systems, is designed to provide the results they produce (Conway & Batalden, 2015; Langley et al., 2009). Looking at it from a systems lens, the short tenure for leadership ensures that the systems' balancing processes keep any attempts at improvement for minoritized populations from taking effect. It has been shown that there is a reciprocal effect between factors such as trust and improving the system and support for students, and that change requires commitment from leaders to build long-term programs not short-term projects (Bryk et al., 2010). Short tenures reduce trust and the ability to commit and pursue long-term projects at institutions (Bryk et al., 2017).

In a discussion of institutional culture, a discussion of leadership stability should be accompanied by a discussion of the use of data for decision making (Chitpin & Evers, 2015). Depending on the use of data at an institution and their ability to disaggregate data, the success statistics for smaller student communities may be grouped and hide low success numbers in averages of small student groups. Furthermore, institutions may not accurately measure the success of smaller student communities due to the limited availability of data. Using aggregated data can lead to underreporting the success and challenges for subpopulations, and some institutions do this for various reasons. The institutions or data professionals may believe it

shows progress in closing equity gaps and reduces complexity for readers (McNair et al., 2020). Disaggregation of data can ensure populations are counted and not ignored or erased from view so that policies and practices to support all students' success can be improved (Vaughn, 2023).

The authors believe that institutions should use their resources to assist all students in being successful if that institution has allowed them to matriculate. Institutions often refer to that group of multiple subpopulations that are relatively small into an underrepresented minority number (URM). An URM number is the average of all the numbers taken, which means it hides those that are below the median and above the median. An URM number robs the leader out of details that are needed so they can make informed decisions on how to help students succeed (McNair et al., 2020; Williams, 2020). Participant 2 highlights the insecurities experienced by her staff during their current leadership transition by sharing the following: "We're also in the midst of an interim chancellor you know, so there's a lot of flux and a lot of change.... So, it is up in the air as to what we intend to do moving forward." This quote highlights how some staff and feel unmoored in any efforts to change or improve their institutional systems because they know that student or institutional efforts and priorities can change when leadership changes. This participant added a critique of leadership because "[their] reluctance to adapt is a major barrier to equity." The sentiment shared by the participant emphasizes the lack of effort to improve student success for Black students, or any other minoritized population, during leadership transition. To sustain an institutional culture that values and operationalizes equity efforts, institutional leaders must remain committed to driving institutional policies and practices toward equity.

This observation about leaders not being present or leadership transitions points to misuse of Bourdieu's (1977) power within the educational field, but it maintains habitus through the traditional distribution of capital. Without a strong reason to continue to make change, which

may involve using some of the leader's personal capital to invoke change, it is easier to let the current system perpetuate so that the leader may use their social capital elsewhere. Bourdieu's capital is referenced in relation to many of the themes discussed in the interviews. Capital is present in the context of anti-DEI sentiments, bias, and leadership.

Equity Leadership Misalignment

The quote from Participant 4 about leadership being averse to change also highlights how leadership drives strategic planning and affects the day-to-day work of faculty, staff, and students. While Participant 2 is at a two-year institution, the same leadership issues also affect four-year institutions. Participant 4 had a few critiques of leadership. To improve outcomes in STEM programs and discover why some students were not succeeding, "[w]e conducted a focus group of Black males... and nothing. Nobody seemed interested in the results we presented to the president, and nothing happened." The participant followed this statement by reflecting on their institution's power dynamics: "Leadership often overlooks the actionable data on disparities" (Participant 4). Despite the participant collecting data on who succeeded in specific programs, including student voice data, the institution's leadership reinforced the existing structures of Bourdieu's capital and the more extensive educational system by not acting. Bourdieu's (1977) theory highlights the processes through which social structures and their inequalities reproduce. Institutional leaders have the power to support or challenge the status quo, thus playing a key role in the reproduction of inequality or not. The way an institution uses resources and strategies, as set by institutional leaders, can significantly affect its ability to address social inequalities and implement effective equity strategies. For instance, budget priorities might favor certain programs over others, leadership changes can shift the focus on DEI and student success efforts, and data use can influence policy and practice decisions.

Educational institutions, in particular, are critical sites for the reproduction of social structure, as they legitimize the distribution of cultural capital that favors the dominant social groups when inaction is taken on the type of data collected and shared by Participant 4.

To combat the reproduction of the status quo, leaders would benefit from a collaborative approach to tackling inequitable structures and decision-making across their institutions. The discussions around institutional leadership should include all levels of the institution: students, staff, faculty, and administrative leaders. One participant shared, “There are many examples of how these [equity] programs can be successful if a concerted effort is made from the top all the way down to change the system” (Participant 4).

While this section has focused on the effect of leadership on efforts to improve equity, it is worth noting that leadership in higher education works within a complex organization with many subsystems. The tension of each system trying to stay in balance and provide its historical output must be acknowledged by leadership. By first recognizing the system from which they work and where their teams are trying to create change, leaders can be an essential driver for change and “catalytic agents for systemic improvement” within that organization (Bryk et al., 2010, p.45). Within this complex system, our participants spoke of their efforts to create change in their areas of leadership and where they had to acknowledge that the larger systems affected their work. Some of those outside pressures included new laws created or being submitted in state legislatures to remove funding and suppress language and the ability to teach about frameworks of power and oppression, such as diversity, equity, and inclusion (DEI) efforts.

Anti-Diversity, Equity, and Inclusion (DEI)

The participants highlighted the anti-DEI theme with examples from external political and societal influences. The interviews reveal how external factors, particularly political

constraints at the state and institutional level, impact efforts to achieve equity. Participant 1 mentioned state policies affecting DEI initiatives to illustrate this challenge. They note, “a lot of our units have been dismantled for DEI... even the terminology we can’t really use anymore.” This political interference resonates with Bourdieu’s (1977) view on how external forces shape educational fields, often perpetuating existing inequalities.

While anti-DEI was not a root issue identified in our causal analysis diagram (Figure 1), the current socio-political landscape of higher education certainly influences the process and impact of doing equity-centered education. Anti-DEI institutional policies affect student success efforts and course complexity issues. In the bigger picture of postsecondary education, we see that policies at the course and department level are affected by more extensive state policies. The state or federal policies can significantly influence many factors impact a student’s success. In light of the new anti-DEI policies, language, funding, and curriculum have been the subject of legislation. For example, in Nebraska, Legislative Bill 1330 seeks to prohibit:

Advancing theories of unconscious or implicit bias, cultural appropriation, allyship, transgenderism, microaggressions, microinvalidation, group marginalization, anti-racism, systemic oppression, ethnocentrism, structural racism or inequity, social justice, intersectionality, neopronouns, inclusive language, heteronormativity, disparate impact, gender identity or theory, racial or sexual privilege, or any concept substantially related to any of these theories. (Section 1.a.iv, 2024)

An attempt to include these topics in discussions or programs, real or imagined, or in an intellectual endeavor can cause institutions to lose funding and other forms of injunctive relief. In the 28 states that have these bills or have legislatures that have these bills proposed, the faculty, staff, and administrators are careful and fearful in how to conduct general business in

case outsiders construe student learning and success as a form of any of the various prohibited activities outlined in the legislation. Participant 2 shared in their interview that their “state policies and institutional barriers [have] dismantle[d] DEI units” in light of the new anti-DEI law in Texas. These anti-DEI efforts focus on forbidding institutions from having staff or offices that provide diversity, equity, or inclusion education. Some state bills aim to ban training that raises awareness of diversity, equity, and inclusion concepts, prohibit consideration of student or staff identities in admissions or employment decisions, and ban all resources and funding for any internal or external support around these efforts (Chronicle staff, 2024). As of March 2024, there are currently 80 anti-DEI bills across 28 states with some form of anti-DEI language (2024).

The anti-DEI theme that emerged from this study highlights an attempt for external legislators to control the culture and limit change at higher education institutions. Not allowing people or organizations to discuss or recognize identities and power structures aligns with Bourdieu’s (1977) concepts of habitus, field, and power structures. It reflects a common theme of resistance to change, both along the lines of being a natural human reaction and that change is challenging to implement because of the complexity of the higher education system (Chitpin & Evers, 2015). Furthermore, the theme of an anti-DEI political landscape provides an example of how power structures external to educational institutions (such as political entities) can exert influence over funding and academic programs. These external forces can limit or eliminate the types of DEI initiatives within the field of education, thus impacting the perpetuation or disruption of social inequalities.

One participant provided an example from her context based on the influence of their state government in Oklahoma. The state legislature has banned DEI language and DEI programming in state-funded institutions. The issue for the institution created conflict because

they are a predominantly Native American serving institution, and Oklahoma’s anti-DEI legislation has resulted in fear and confusion across the campus about what could be said, if specific programs could continue, and how the Native American community relationship with the institution would fare. One approach this leader uses is to be aware of where and how DEI language is used in connection with funding sources. When discussing federal funding, they continue to use DEI language about how that funding affects or improves programming. To obey Oklahoma’s anti-DEI mandate, the participants, and their colleagues ensure no state money is associated with anything related to DEI. Participant 1 stated, “It gets real sticky and complicated when we try to figure out who’s paying for what.” The discrepancy between what state and federal monies can be used creates confusion and fear for faculty, staff, and students.

Navigating the “Sticky and Complicated” Landscape

While the current anti-DEI landscape might be “sticky and complicated,” according to the participant quote shared above, they also shared that it is important in their community to be visibly inclusive and celebratory of Oklahoma’s tribal communities. Their institution receives federal funding to create and sustain programming for Native populations, so it is important their efforts and programs have external visibility. However, making this same external visibility also creates fear because it conflicts with state legislation.

While two out of five participants were in states that currently prohibit some form of DEI work, two others were in states considering prohibition, and only one was in a pro-equity state and institution. Regardless of the participant's state, all participants emphasized the need to ensure that all students were being served and provided services to help them succeed. Participant 2 was optimistic that their efforts to remove curricular complexity and barriers would continue; they also recognized that “DEI efforts are hindered by systemic barriers.” Indeed,

institutions must aim to challenge systemic norms and barriers and actively work toward equity. By exposing and discussing power dynamics, the participants feel hopeful in supporting diversity, equity, and inclusion efforts for marginalized groups at their institutions.

Act: Implications for Future Practice and Research

The final stage in the PDSA cycle is Act. The purpose of the Act stage is to take action on the data collected from the intervention and use it to inform practice and/or another PDSA cycle. Using our findings and existing literature as guideposts, we offer four recommendations for educational leaders to consider in the future. These recommendations focus on the following topics: 1) language, 2) mitigating bias, 3) data informed decision making, and 4) sustaining equity efforts through accountability. Additionally, we share our limitations for this current study as well as recommendations for future research.

Language Matters

The effects of anti-DEI policies critically influence internal culture. According to The Chronicle of Higher Education's DEI Legislation Tracker, since March 2024, 80 anti-DEI bills have been introduced in 28 states and U.S. Congress. These 80 bills seek to prohibit colleges and universities from having DEI staff or programming, mandatory DEI training, and stop admissions from admitting students based on race, sex, ethnicity, or nationality (Chronicle Staff, 2024). There were some participants that were in states where new funding was being funneled into DEI efforts. It was interesting to note that even for the person in a pro-DEI state, they were already using language such as "all students" to avoid the words diversity, equity, and inclusion.

While creating the professional development equity workshops for this study, we found navigating these policies and legislation a constant concern. Throughout this study, we found the most significant concern for institutions is that their state funding is contingent on legislative

adherence. While we were creating these equity workshops, significant consideration was given as to what to name them because any use of DEI language would prohibit participation in some states. Once we began data collection, we learned that our participants were experiencing the impact of anti-DEI legislation at the present time. This is succinctly illustrated by Participant 2, the director of curriculum and compliance at a community college in Texas, who shared in a session discussion, “We continue to do the work, but we just do not state it as DEI. Even our office of DEI has been dismantled.” How participants are navigating and adapting to anti-DEI legislation in their work remains unclear. When asked what strategies are being employed to ensure compliance, Participant 2 went on to state “Honestly, I think we're still determining where that's gonna go. Right now, we're not doing anything around it.” This participant and the one from Oklahoma provided context for analyzing and improving student outcomes despite limitations of language, mental models, and frameworks that are now illegal in those states (Alonso, 2023). These discussions with the participants revealed that the language used to discuss diversity, equity, and inclusion efforts, is critical when recruiting participants, sharing literature and information because it can jeopardize state funding. As a result, it is recommended that caution be used when planning and designing efforts to address inequities. As other participants shared, even though they were not in a hostile environment to DEI work, they still used inclusive language that would allow the discussions to consider policies, practices, and other structural barriers that might be resulting in outcomes that looked inequitable. The challenge is to keep the discussion framed so the participants feel safe to participate wherever they might be in their journey of reckoning with the historical social, cultural, and political forces that have created and reinforced the postsecondary system of today (McNair et al., 2020).

Mitigating Bias

The focus of this study, to address the inequities experienced by Black students in STEM academic programs, originated from our professional experiences and conversation with colleagues. These experiences led us to review academic literature in order to understand the academic conversation surrounding this issue and identify where we could join the conversation. The findings of this study substantiate our professional understanding and assumptions that race and class are issues in higher education that create negative outcomes for Black student populations, and that new approaches and policies are needed (Baker, 2021). The systemic issues facing Black students in higher education STEM programs were created by public and institutional policies and must be addressed in the same way.

The second session emphasized the need to acknowledge implicit bias, which refers to the unconscious use of stereotypes (Carter et al., 2016). Addressing implicit bias in STEM programming and in higher education is imperative in creating equitable student outcomes. Implicit bias of some faculty and staff has created and perpetuated inequitable policies, such as placement testing, that results in minoritized students being placed in remedial courses that ensure they cannot get placed in a STEM program without taking additional courses. This makes their time to degree completion longer and more costly. One participant shared that at their college they tried to use placement tests, and what they found was that the students needed study skills, not remedial courses. Our literature review also illuminated that many institutional efforts purporting to help students succeed through a deficit-oriented lens fueled by implicit bias, that results in placing students as the root cause of their lack of success instead of centering the teaching and support systems as the root of the hindrance of student success (Paunesku, 2019; Whetten, 2021). It is clear based on the findings of our study that the perceptions of our

participants are in keeping with academic research that bias is a key factor that maintains structural racism in STEM programs and perpetuates unfair outcomes spanning a lifetime by impeding the social mobility of Black and other underrepresented students (Canning et al., 2019; Loza, 2003; Park et al., 2019).

It is through these findings that we recommend campus-wide professional development training to gain awareness and understanding of implicit bias and how it affects outcomes for Black and other students that are negatively affected by policies and practices and supported by data. We recommend institutions implement a scaffolded, equity-focused professional development initiative, similar to the three equity workshops created for this improvement initiative. We are also aware of the language issues that are intertwined with the recommended professional development initiative that uses many of the words in this paper such as equity, diversity, inclusive, bias, or racism to name a few. But we found that participants were already shifting their language so that race, ethnicity, and socioeconomic status were not mentioned during our discussions. In fact, throughout the second equity session that discussed implicit bias, they demonstrated a positive change in their perceptions of how they, as individuals, can impact their systems to address inequities and do so by emphasizing how that work supports ALL students. We believe that institutions should use a similar and contextual approach to their professional development work. Whether we are working for any subpopulation such as Black students, or the myriad of other race/ethnicity, first-generation, or low socioeconomic status students to name some subgroups, the work to help one group should follow a similar approach of discussions and analysis to find root causes and designing levers of change. Given this finding, we recommend that campus-wide implicit bias training to address how it impacts

institutional policies that result in reduced access to degree attainment for Black students in STEM programs.

Data-Informed Decision-Making

Through our review of the literature and data analysis, we found a vital need for faculty to critically examine and address how STEM course complexity and sequencing negatively impacts persistence and degree completion for Black students. We found participants believe the implicit bias of some faculty influences the programs they develop. Participants shared that there are some faculty that create programming for students they believe have similar attributes as themselves, and because of their bias students that differ from them racially or with different backgrounds do not have the same access to STEM programming. Because educational systems were established and are currently maintained by the White middle class, it is structured on their social and cultural values and knowledge (Loza, 2003). The White middle-class structure of education means non-White and economically disadvantaged people are not set up to succeed within society.

Introductory STEM courses are often used by faculty to intentionally “weed out” students since some faculty believe that not all students can be successful in STEM programs, and that part of their role as faculty is to serve as gatekeepers of who is allowed to be successful in STEM degree attainment (Canning et al., 2019). It has been found that gatekeeping strategies result in White male students who complete STEM introductory courses with a C grade or higher being 48% more likely than any other student population to complete a STEM degree (Hatfield et al., 2022). The social and cultural implications of these gatekeeping strategies are evident when reviewing the National Science Foundation (2017) data showing that Black students make up

only 12% of STEM majors and that 2% of Black women and 3% of Black men make up the STEM workforce.

Analysis of our data found that administrators, faculty, and staff experience challenges accessing and using data to inform decision-making. Many programs utilize gender, race, and ethnicity, but it is not enough and there should be better systems to gather and report disaggregated data. In many instances, data is presented and discussed but it does not result in actions. Our third session was devoted to using data to inform decision-making for advancing equity efforts in an institutional context. The discussions were about gathering the data and being able to disaggregate it and being able to discuss and reflect on findings in the data.

Our findings show the importance of using data to critically examine STEM programs to create more equitable student outcomes, and it also reflects a common thread in literature that data is difficult to obtain. Participant 4 shared that they could not always get disaggregated data, and when they could do some targeted surveying, they could not follow up with focus groups to get additional qualitative data. Ultimately, educational leaders must have regular access to disaggregated data to improve student outcomes and uncover implicit bias of faculty and institutions. This discovery work requires being able to use disaggregated data at the course level and discussions with others in the department, the data team, the student success area, and where appropriate, students. As Freire (1970) shares, discussion is required so that there can be reflection and action, but that discussion needs to occur with an openness to understanding how the current system produces the results. Utilizing improvement science methodology, educational leaders should take time to analyze the data with a causal analysis or fishbone diagram and then drill further into those areas with the five-whys protocol to understand the root issues. Another important aspect of assessing data is to be mindful of the language being used. McNair et al.

(2020) provide examples of equity gaps and disaggregation terms and suggest using the Center for Urban Education’s equity-minded sensemaking process that would include prompts to invite “critical reflection, contextualization, and meaning-making” (p. 61). The prompts might include questions such as:

- What race/ethnicity or socioeconomic groups are you noticing in the data?
- Are there patterns?
- Are there particular groups that stand out?
- In a course, section, or program?

Sustaining DEI Efforts Through Accountability

Stable leadership creates institutional capacity to adapt to changing student demographics (Felten et al., 2016; Kezar & Eckel, 2002). Leadership drives institutional strategic planning and the areas of focus that influence day-to-day work of faculty, staff, and students. Our study revealed that leadership has an overwhelming impact on DEI efforts and student outcomes for minoritized students. Across all the data we collected, leadership instability was consistently identified as having a critical impact on sustaining DEI efforts through leadership transitions. A 2022 report by The Chronicle of Higher Education found that college presidents stay in their positions for an average of 5.9 years, and this is a decrease from years past. This decrease of leadership tenure creates challenges of the instability of institutional leadership, thus making equity efforts difficult to sustain (Jesse, 2023).

Our study identified the importance that data has on DEI work, and the need to establish systems and policies with accountability measures to sustain these efforts. Our results support the need to establish accountability measures for institutions to sustain DEI efforts, especially during times of leadership transition. These efforts require policies to ensure accountability that DEI

efforts result in change. Participants shared the negative impact due to the lack of accountability policies. For example, three of the participants discussed that there are no mechanisms for accountability at their institutions such as merit pay like other industries. One participant summed it up nicely by saying, “there are no carrots or sticks.” While institutional leaders can set goals to increase retention and graduation rates of Black students, our data analysis highlights the lack of strategies to reach these goals, such as who will do the work, and who will be accountable for outcomes.

Leadership transitions occur more often as the tenure of college presidents continues to shrink (Jesse, 2023). The negative impact that leadership instability has on sustaining DEI efforts leads us to recommend the implementation of accountability policies as an important component to ensure DEI work is sustained through leadership changes (O'Day, 2002). Policies are needed to address problems and ensure accountability for results. Participant 5 brought this into focus by stating, “We need to identify the gap in student outcomes and be forced to address it... this is accountability.” We offer the following strategies that educational leaders might consider in strengthening accountability for the DEI efforts at their institutions:

- Student outcomes should be considered at the beginning of conversations and embedded in the incentive structures for staff and administrators and the tenure and promotion reviews for faculty.
- Have a forum and allow language to name and discuss inequities around student success. Someone needs to have responsibility, and that responsibility should be close to the president of the institution.
- Use institutional data to provide historical baselines as well as to set and track outcome and short-term goals.

- Data, and improvement science methods, should be used to test changes in policies, processes, and practices so that corrections can be made when a change appears to increase harm without waiting too long, and expansions can be taken when a successful intervention is found (Langley et al., 2009; Laursen & Austin, 2020).

Indeed, institutional policies to address accountability for results of DEI programming are necessary to mitigate the instability created by the frequency of changing leadership and to formally educate new leaders on institutional strategic goals even before they start (Keenan, 2018).

It is important to recognize that there has long been an absence of ethics and accountability in higher education for their collective work and responsibility, which includes efforts that involve culture change around student success. There was the U.S. higher education law in 2007 that encouraged the National Science Foundation to require grant recipients to be trained in ethical research, but according to Keenan, the grantee only needs to acknowledge they have a form of certification (Keenan, 2018). Additionally, for those faculty that want to join American Association of University Professors, they have a Code of Conduct, but it is not focused on the student, and one can argue that the primary role of higher education should be to the community at large instead of, as stated in their ethics page, a “deep conviction to advance knowledge” and “devote their energies to developing and improving their scholarly competence.” Improving scholarly competence as it stands today, and within Bourdieu’s theory or cultural reproduction, is a key factor of why education reproduces the inequities of our culture and society (American Association of University Professors, 2015). We recognize that some higher learning accreditors are starting to build in equity concepts, but it remains to be seen how institutions will fulfill those requirements given cultural and political forces. Institutions could

meet the spirit or only the letter of those requirements. If institutions react as Mississippi did when James Meredith was accepted to Ole Miss in 1962, new ways of Erle Johnston's "practical segregation" may emerge at the institution and department level as they seek to "avoid the minefield of race as an open topic," and the legislation being tracked by the Chronicle of Higher Education shows that there are at least 28 states that seeking modern methods of "practical segregation" both along race lines and expanding them (Luckett, 2021, p. 226). Due to the complexity of the higher education system, who is enrolled and who succeeds depends on coordination between many systems to create different outcomes, and every system is created to produce the outcome it achieves (Conway & Batalden, 2015; Langley et al., 2009).

Study Limitations

One of the most significant limitations of this study was the small size. As discussed, due to an unsuccessful participant recruitment effort required us to pivot to using a smaller sample size and to mitigate that by adding additional data collection methods and measuring the impact of the initiative. Working with a larger sample size will yield richer data collections to inform outcome measures and recommendations for practice and opportunities of future research.

We heard from each participant that they thought the synchronous sessions would be longer and that they did not think 45 minutes was enough time for fruitful discussion. We used the workshop time to collect signed participation consent forms, administer surveys, and to provide an overview of the session and agendas. This approach to time management of the 45-minute sessions limited the time remaining for group discussion. This reduced time potentially impeded the discussions that served to provide opportunities for the participants to learn from their colleagues through sharing their experiences (Henning, 2012). Exploring other approaches

to gathering data that also ensures participant completion of surveys without compromising the time for group discussion is recommended going forward.

We administered the pre-survey and pulse surveys during the time used for the first two equity sessions, which created less time for group discussion. The participants wanted more time to discuss content instead of complete surveys, so we used the final session for group discussion only. Using session time for data collection resulted in 100% survey responses. Not using time in session for the post-survey resulted in a poor response rate of 40%, which is why we chose not to use the post-survey as an outcome measure. However, we received an 80% participation rate for the individual interviews, providing rich data to inform our outcome measure.

Implications for Future Research

Along with the identified limitations of this initiative, there are a few areas for further research. Our original recruitment efforts began in early summer and resulted in no one opting to participate in this study. The lack of potential participant interest caused us to conclude that asking faculty to take on additional work required of the equity modules during the summer was an easily identifiable obstacle. We recognized that many faculty members are contracted by their institution to work nine or ten months of the year, with June and July being the two months not covered in their contractual obligations. Beginning this initiative in summer, combined with requiring participants to agree to additional obligations during the summer months when they typically are off (or have a significantly lighter workload), resulted in a failed recruitment effort and the need to pivot the initiative timeline and potential participant pool. This experience led us to strongly recommend that practitioners plan recruitment efforts during the academic year and avoid designing an intervention that would require faculty participant engagement during the summer break months of June and July.

Although it was not our original plan to target previous CAC members for this study, we found this a tremendous asset, as participants already had a baseline awareness and knowledge related to curricular complexity and analytics. This creates an opportunity to analyze participants' baseline understanding of curricular complexity and the inequitable outcomes it presents for Black students. The participants in this study had already been through a 12-week CAC course, which required them to analyze the curricular complexity of their programs using the visual mapping curricular analytics tool. We see this as a tremendous opportunity to elevate future research by embedding equity-centered training modules into new and existing CAC courses.

Another area for future research is providing content that provides practical implementation strategies to address inequities. This was highlighted in an anonymous discussion board comment stating the sessions and materials lacked practical approaches to addressing inequities Black students experience. This comment revealed an area of opportunity for future PDSA cycles to include information and materials that contain practical approaches to address inequities in their programs.

Conclusion

This improvement initiative sought to address barriers related to post-secondary degree attainment for Black students in STEM programs. Despite decades of programming to address the inequitable student outcomes of Black students, this lag in STEM degree attainment persists. (Elrod & Kezar, 2017; Felten, et al., 2016). Institutional efforts to support Black students have failed in creating and sustaining in efforts that have resulted in positive changes. Deficit language and personal bias often lay blame on students for factors that impede and prohibit their success. The purpose of this research project was to increase faculty capacity through equity-

centered professional development workshops to disrupt reproduction of social and institutional inequities enacted through curricular complexity. Consequently, our theory of improvement held that participation in equity-focused professional development sessions would increase the capacity to understand how curriculum complexity prohibits student success and creates inequitable outcomes that disproportionality affects Black student populations.

Using improvement science methodology, we focused on creating small-scale change to increase faculty capacity by creating three equity-focused professional development workshops. Our intervention consisted of a Plan, Do, Study, Act (PDSA) cycle. We used improvement science as our method of inquiry, and the PDSA cycle provided a method of continuous improvement to test our change ideas. These cycles were designed to be short, time-bound, pragmatic scientific experiments we used to test our hypothesis in a complex system (Carnegie Foundation for the Advancement of Teaching, 2022). We tested our improvement initiative using four measures - outcome, driver, balance, process – and we found that our intervention had a positive impact on deepening participants’ awareness and knowledge of equity related to curricular complexity. All participants felt that they had the ability to affect change and influence student success and equity efforts at their institution even if they had to use different language to advance those efforts because of the current anti-DEI landscape. Most important to the intervention, participants indicated that they wanted to take the time to gain a broader view of Black student success efforts in STEM across the country over the last 30 years. This research project did not promise a silver bullet or magic solution to increase Black student success in STEM fields. However, what it did offer was an opportunity for each participant to gain a broader perspective and engage in equity-based learning and development with colleagues outside of their institution. We found that the participants wanted to do more. Finally, the next

PDSA cycle would examine different ways to take the equity lens primed by these topics of demographic change, bias, and data and start to look at how to integrate it into ongoing discussions of curricular complexity, course redesign, and how to improve student success in course sequences and programs.

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APPENDIX A

Curricular Analytics Definitions

The following are the basic definitions of components that make up a program's complexity.

Blocking Factor

The blocking factor is an important curriculum-based metric because it measures the extent to which one course blocks the ability to take other courses in the curriculum. That is, a course with a high blocking factor acts as a gateway to many other courses in the curriculum. Students who are unable to pass the gateway course will be blocked from taking many other courses in the curriculum.

Centrality

A course can be thought of as central to a curriculum if it requires several foundational courses as prerequisites, and the course itself serves as a prerequisite to many additional discipline-specific courses in the curriculum. The centrality metric is meant to capture this notion.

Course Complexity

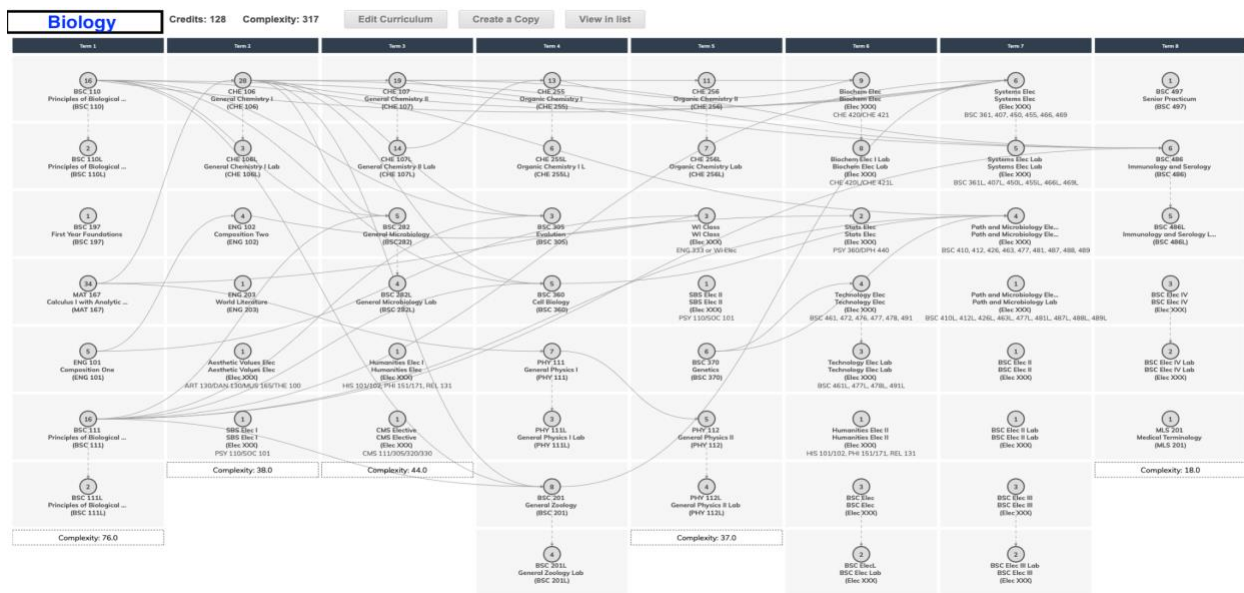
The curricular complexity of a course is meant to capture the impact of curricular structure on student progression. Through experimentation, we have found that a simple linear combination of the delay and blocking factors provides a good measure for quantifying the structural complexity of a curriculum.

Delay Factor

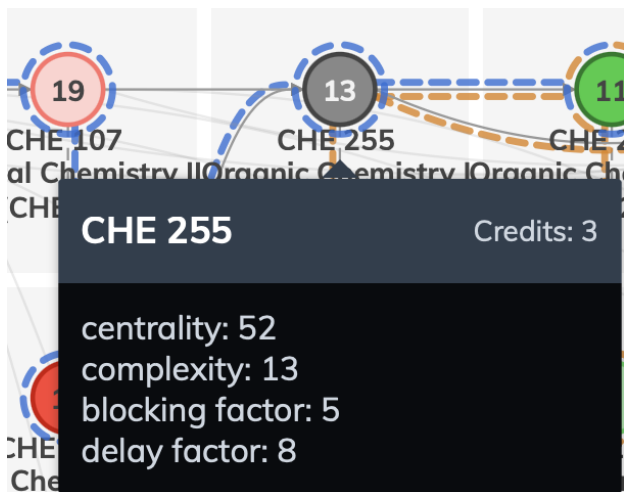
Many curricula, particularly those in science, technology engineering and math (STEM) fields, contain a set of courses that must be completed in sequential order. The ability to successfully navigate these long pathways without delay is critical for student success and on-time graduation. If any course on the pathway is not completed on time, the student will then be delayed in completing the entire pathway by one term. The delay factor metric allows us to quantify this effect.

(Damour Systems, PBC)

Curricular Analytics Complexity Map



Detail of metrics for a course in the curriculum



What is Curricular Complexity?

Complexity of a program for our purposes specifically refers to the number and sequence of courses that students must pass to complete the program and the number of dependencies built into that sequence through prerequisite and corequisite courses (Heileman et al., 2017). The more complex a program, the greater chance a student will be delayed in progression through a program if they fail a course. An increase in a program's complexity can delay or derail student achievement particularly if the student does not receive a passing grade in a course with a high complexity value. A highly complex course blocks access to other courses required to complete the program. Courses created with dependencies can easily block student progress in their designated program and delay progress towards any degree. For example, at one institution, a student majoring in chemistry would need to receive a passing grade in both their General Chemistry and Organic Chemistry courses to progress in the major. The only exception for students to not take these courses is to have received high school AP credit or transfer credit from another higher education institution (K. Krumpe, personal communication, March 9, 2023). Complexity is not good or bad; it is a factor for consideration when designing programs. Factors fostering program design, and resulting complexities, include policies, practices, interpretations of accrediting standards, and various cultures in disciplines, departments, and the institution (Felten et al., 2016).

APPENDIX B

Equity Learning Syllabus

Equity Learning Module for the Curricular Analytics Community - a practitioner approach to reflecting on equity in curricular complexity analysis.

Instructors: Brandy S. Bowman, Rob Rodier

May-August 2023 Cohort for Curricular Analytics Community

Meeting days and times:

Location: Synchronous meetings via Zoom. Some meetings will be concurrent with CAC meetings and some additional institution-only meetings with the instructors.

Learning Outcomes:

1. Participants will be able to apply an equity lens to their causal analysis and driver diagrams when considering the implications of curricular complexity.
2. Participants will be able to apply an equity lens when they integrate institutional student-level program data into their curricular complexity discussions.
3. DO we need a third - anything else that should be included as an OUTCOME.

Readings from the following will be provided during the equity learning portion of the improvement effort. Readings will be provided prior to synchronous meetings and institutional participants will participate in discussions about the readings. The readings are provided to frame equity as a lens for reviewing program design in higher education. The post-session surveys are to solicit feedback on how the learning material can be improved.

Consent forms and IRB approval for all participants will be required. Pre-/ post-survey for equity module: The purpose of the survey is to gather quantitative data to determine if readings increase understanding of equity in higher education and curriculum design and solicit feedback on how the learning material of the course can be improved.

Meeting #1:

1. Intros
2. Purpose / what you get.
3. Consent signed.
4. Pre-Survey
5. Why Increasing Student Success in STEM is Important to the U.S. and Institutions

Discussion prompts for readings:

- How have demographic, racial and ethnic, and class populations changed at your institution and in your program over the last 20 years? Review IPEDS tables for reference.
- How has this affected your program and courses?
- Have the outcomes of your programs been affected?

- What thoughts and/or actions do you have about the ABET and NSF issues of STEM discussed in the readings?

Meeting #2: Implicit bias and introductory course design

Welcome to the learning module on "Navigating Implicit Bias and Fostering Inclusive Learning Environments." In today's increasingly diverse and interconnected world, it is essential to address two critical aspects of education: recognizing and mitigating implicit bias and creating inclusive and equitable learning environments. These two articles serve as the foundation for our exploration and understanding of these vital topics.

Do introductory courses disproportionately drive minoritized students out of STEM pathways? Neil Hatfield, Nathaniel Brown, Chad M Topaz, *PNAS Nexus*, Volume 1, Issue 4, September 2022, pgac167, <https://doi.org/10.1093/pnasnexus/pgac167>

The article sheds light on disparities in science, technology, engineering, and mathematics (STEM) education. It explores how introductory STEM courses can disproportionately impact underrepresented minority students leading to lower STEM degree attainment rates. This article underscores the need to create more inclusive and equitable learning environments that support all students, regardless of their background.

Article 1: "Don't Talk about Implicit Bias Without Talking about Structural Racism" by Kathleen Osta (@KathleenOstaNEP) and Hugh Vasquez (@HughJVasquez), National Equity Project (2019)
<https://www.nationalequityproject.org/articles/dont-talk-about-implicit-bias-without-talking-about-structural-racism>

Implicit bias refers to the unconscious associations and stereotypes we hold about different groups of people. While these biases may operate beneath our conscious awareness, they have real-world consequences, affecting our decision-making processes and interactions with others. This first article highlights the need for self-examination at the personal and organizational levels, to confront biases and dismantle policies and structures that perpetuate inequality.

Discussion prompts for readings:

1. How can higher education institutions redesign and reform their introductory courses to ensure that they are more inclusive and equitable, particularly for underrepresented minority students?
2. What are some potential strategies and interventions that could be implemented to address the disparities in degree attainment highlighted in the study? How can universities support students who may struggle in these introductory courses regardless of racial, ethnic, or socio-economic characteristics?
3. What broader systemic changes are needed in education, from K-12 through higher education, to create a more diverse and inclusive workforce? How can these changes be driven by both institutional efforts and broader societal initiatives?
4. What priming, associations, policies and assumptions contribute to the manifestation of implicit bias for you and/or your organization? Can you provide examples of how these processes affect decision-making and behaviors in various contexts?

5. The article argues that addressing implicit bias alone is insufficient for achieving equity. What are some specific strategies or policies that your organization, system, or accreditors can implement to tackle both implicit bias and structural racism simultaneously?
6. In your opinion, what role do leaders and individuals play in recognizing and mitigating their own implicit biases? How can individuals engage in "mirror work" to confront their biases while also participating in "window work" to address systemic racism on a broader scale?

Additional readings

Why Racial Equity Needs Discussion in Education and Gorski, P. (2019). Avoiding Racial Equity Detours. *Education Leadership*, 76(7), 56–61.

Steele, C. (2011). *Whistling Vivaldi: How stereotypes affect us and what we can do*. W.W. Norton.

Racial Equity Detours Discussion Question Handout

Discussion Prompts for Readings:

- Do you think your Institution engages in any of the equity detours mentioned?
- How might you reexamine institutional initiatives with an equity lens?
- Do you agree with Gorski's point that schools "must prioritize equity over the comfort of reluctant educators"? What would this look like?

Meeting #3: Using Data to Advance Equity in an Institutional Context

McNair, T. B., Bensimon, E. M., & Malcom-Piqueux, L. E. (2020). Chapter 3: Using and Communicating Data as a Tool to Advance Equity. In *From equity talk to equity walk: Expanding practitioner knowledge for racial justice in Higher Education* (pp. 53–78). essay, Jossey-Bass, a Wiley Brand.

Discussion prompts for readings:

- How do we identify and understand how inequities show up on campus and in our spheres of influence?
- How does the institution hold itself accountable for being anti-racist?
- How do we hold ourselves, our department, and our courses accountable for being anti-racist?
- What are ways for operationalizing our equity values and goals?
- How do we prepare the next generation of strategic leaders and thinkers to break down racial hierarchies and dismantle the belief in the hierarchy of human value?
- How does your institution refer to faculty, staff, and students that do not identify as White? Do they look like the words discussed (URM, underrepresented minorities, BIPOC, etc.), and if so, what purpose does that term serve? Did the people being described by that term choose it? Who does that term benefit or harm? hide or highlight?

Additional Resources:

Changing faculty culture to promote diversity, equity, and inclusion in STEM Education. Speed, J., Pair, D. L., Zargham, M., Yao, Z., & Franco, S. (2019). Changing faculty culture to promote diversity, equity, and inclusion in STEM Education. *Culturally Responsive Strategies*

for Reforming STEM Higher Education, 53–72. <https://doi.org/10.1108/978-1-78743-405-920191004>

Institute for Higher Education Policy – Toward a Convergence: A Technical Guide for the Postsecondary Metrics Framework: <https://www.ihep.org/publication/toward-convergence-a-technical-guide-for-the-postsecondary-metrics-framework/>

We encourage a thorough review of the materials. We have also included a selected list of metrics (found in Appendix C) to review. These selected data elements should be available to your institution with little to no modification to your institution’s current reporting frameworks.

APPENDIX C

Equity Metrics from the Authors and Institute for Higher Education Policy’s (IHEP)

Student Demographic Characteristics for Equity

Student Demographics	Definitions
Academic Year *	Academic year of reported data
Term *	Term of reported data
Total Students in Program Cohort	Total number of degree-seeking students in program cohort
Enrollment status	Status types are first-time, transfer-in, or continuing students.
Attendance Intensity	Current status of students’ enrollment if possible. Standard measure looks a student’s enrollment status as of first full-length term, which might be two years before joining the program. Full-time or part-time determined by number of credit hours taken
Credential-seeking Status	Certificate-, associate’s-, bachelor’s-, or non-credential-seeking students
Program of Study	Six-digit Classification of Instructional Program (CIP) code and reported for seven meta-majors
Academic Preparation	Institutions classify students as “not college ready” or “college ready” in math and English
Economic Status	Pell Grant status as proxy for low-income or economic status
Race / Ethnicity	Current IPEDS categories: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Two or more races, Nonresident alien, and Race/ethnicity unknown
Gender	Male, female, or other
First-generation **	Using the Federal TRIO program definition where a student’s parents did not complete a baccalaureate degree. If the student is primarily

	raised by a single parent, then they did not complete a baccalaureate degree.
Age	Collected by date of birth, if available; otherwise reported by three categories: 19 and under, 20–24, 25 and over
Cumulative GPA *	GPA at end of term for all post-secondary work
Program GPA *	GPA of all program courses
Program Credits Attempted *	Number of course credits attempted in the program, including courses transferred.
Program Credits Completed *	Number of credits counted towards program completion with a successful grade.

Note. The table shows the demographics used to define students and examine possible equity differences in program outcomes. IHEP is a nonpartisan, nonprofit organization committed to promoting access to and success in higher education for all students (Janice & Voight, 2016).

* These definitions are added to account for the academic year of the program being reviewed and to note program persistence and completion measures in relation to their overall post-secondary career. It is from the institution’ department or Institutional Research staff.

** While listed in IHEP’s equity measures, the definition in this improvement project uses the Department of Education’s TRIO definition for first generation students. First generation is a proxy for cultural capital for student success (NASPA and the Suder Foundation, 2017).

APPENDIX D

Participation Consent Form

The following consent form will be distributed through Western Carolina University's Qualtrics. You may review the survey through the following link:

https://wcu.az1.qualtrics.com/jfe/preview/previewId/dceef85b-93e9-471c-8114-471a2e57fe51/SV_2i7FYQkLlJaK6vI?Q_CHL=preview&Q_SurveyVersionID=current

The forms content is copied below:

Welcome to the Curricular Analytics Community research study for the Dissertation work of

Brandy Bowman and Robert Rodier,
Western Carolina University
Education Leadership Ed. D. Candidates

You are invited to participate in a research study examining degree programs' course sequencing and their related complexities' impact on student success. This study hopes to increase the capacity of higher education faculty and staff through the use of a Curricular Complexity tool and Improvement Science tools to examine how their program designs create inequitable student outcomes across student populations.

Brandy and Rob are interested in how an understanding of Curricular Complexity in academic programs affects student success in aggregate and across student populations, particularly race/ethnicity, gender, first-generation, and low socio-economic status.

For this study, you will participate in the Gardner Institute's Curricular Analytics Community (CAC) and can expect access to curricular analytics and improvement science tools that have been intentionally developed to guide a process of identifying opportunities for curricular redesign. The format of the CAC includes asynchronous content, and four synchronous meetings coinciding with Modules opened up at set periods. See Appendix E for a sample syllabus. Synchronous meetings will include other participants in the CAC and the Gardner Institute facilitators. Participation for this project will include at least one extra meeting with the institutional representatives with Brandy Bowman and Robert Rodier. Through the initial engagement period, participants will complete deliverables that will be aggregated to form a final report and plan that they can then implement at their institution. Those deliverables include loading curriculum into the Curricular Complexity tool, completing a causal analysis of the program, completing a driver diagram for the analyzed program, participating in a community of practice completing pre and post-test instruments creating and completing a 90-day Plan, Do, Study, Act plan.

The study includes a pre- and post-CAC survey and six additional meetings with Brandy and Rob to discuss the outcomes shared in the in-person meetings as well as a final synchronous

meeting after the course. The surveys should take you around three minutes each to complete. The additional meeting will be scheduled for sixty minutes. Your participation in this research is voluntary. You have the right to withdraw at any point during the study. The Principal Investigator of this study can be contacted at Dr. Dustin Evatt, devatt@wcu.edu.

Title: _____

First Name: _____

Last Name: _____

Preferred pronouns: _____

Email (please use your institution-affiliated address) _____

By clicking the button below, you acknowledge:

- Your participation in the study is voluntary.
- You are 18 years of age.
- You are aware that you may choose to terminate your participation at any time for any reason.
-

I consent, begin the study

I do not consent, I do not wish to participate

APPENDIX E

Pulse Survey (Post class)

The following is the post-synchronous class survey that will be sent out multiple times. The survey will be distributed through Western Carolina University's Qualtrics. You may review the survey through the following link:

https://wcu.az1.qualtrics.com/jfe/preview/previewId/64408d0d-dbaa-4ccb-85ad-1f208a3ce698/SV_ezJQPtVjYIXXE7I?Q_CHL=preview&Q_SurveyVersionID=current

Block: CAC Equity Module Class Session Evaluation (4 Questions)

Q1 The purpose of this survey is to collect feedback on today's content with Brandy Bowman and Rob Rodier. It will take only 3 to 4 minutes. Your feedback will be used to help Brandy and Rob improve the material. You are not required to respond to any of these questions.

Please share your institution name. _____

Q2 Did the readings help increase your understanding of the topic?

- Extremely helpful (1)
- Very helpful (2)
- Moderately helpful (3)
- Slightly helpful (4)
- Not helpful at all (5)

Q3 How helpful is the reading's equity concept important to curricular complexity and program design?

- Extremely helpful (1)
- Very helpful (2)
- Moderately helpful (3)
- Slightly helpful (4)
- Not at all helpful (5)

Q4 How can the reading material or discussion be improved?

Q5 Is this work impacting your work outside of the CAC?

- Definitely a positive impact (1)
- Probably a positive impact (2)
- Might or might not be impacting my work (3)
- Probably a negative impact (4)
- Definitely a negative impact (5)

End of Block: Equity Module Class Session Evaluation

APPENDIX F

Pre-/Post-Test Survey

Equity in Curricular Analytics Pre-/Post- Test Survey

Start of Block: Equity in Curricular Analytics Pre-/Post- Test Survey

This instrument asks for your feedback about a tool that helps visualize curricular complexity.

Thank you - Brandy Bowman and Robert Rodier

You are not required to complete the survey to participate in the Curricular Analytics Community. This is a survey for the disquisition work of Ed.D. candidates Brandy Bowman and Rob Rodier. The information will not be tied to you.

Q1 Program Complexity

- Faculty should design their programs to meet accreditation standards, to be only as complex as necessary, and to recognize prior learning when and where possible.
- We believe that it is possible to layout the curriculum and calculate complexity and other factors to increase success rates in programs that may currently have low success rates or discourage participation from students that are from less resourced high schools. We also believe rigor can be retained while increasing rates of student success and their learning.

Q2 What is your initial reaction to this concept?

- Extremely positive (1)
- Somewhat positive (2)
- Neither positive nor negative (3)

Q3 How appealing is this concept compared to other products currently available?

- Extremely appealing (1)
- Very appealing (2)
- Somewhat appealing (3)

Q4 How prepared is your program to teach concepts to diverse learners?

- Adequately prepared (2)
- Prepared (3)
- Not prepared (5)

Q5 Our program faculty adequately reflect the diversity of society

- Extremely adequate in our diversity (1)
- Adequate diversity (2)
- Very inadequate diversity (3)

Q6 Faculty understand how student backgrounds support their success

- Extremely informed understanding (2)
- Adequate understanding (1)
- Very inadequate understanding (4)

Q7 Faculty and the department are informed on how to design curricula for all students to succeed

- Extremely informed (1)
- Adequately informed (2)

- Inadequately informed (3)

Q8 How relevant is this concept to you personally?

- Extremely relevant (1)
- Moderately relevant (2)
- Slightly relevant (3)
- Neither relevant nor irrelevant (4)
- Slightly irrelevant (5)
- Moderately irrelevant (6)
- Extremely irrelevant (7)

Q9 From the list below, which best describes your thinking about this concept?

- I need it because nothing else solves this problem (1)
- This would be slightly better than what I am currently using (2)
- This is essentially the same as what I am currently using (3)
- What I am currently using is better than this (4)
- I don't see any reason to use this (5)

Q10 How much does the curricular complexity influence success in the program?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

Q11 How does the curricular complexity influence the success of underrepresented populations of students in the program?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

Q12 Is there instructor bias in the program design?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

End of Block: Equity Modules Pre-/Post- Test Survey

APPENDIX G

Class Session Follow-up Emails

Session 1: Follow Up Ed.D. team and Incubator participants.

Dear Equity Module participants and CAC Incubator participants,

Thank you for your engaged participation in Tuesday's session. We are excited and grateful for your time and energy you shared and will be sharing with us over the coming weeks. At the end of this message are links to the session slides, recordings, and resources. For our remaining meetings, we will spend the first 30 minutes focusing on the Equity module related work and discussions and the second 30 minutes will be focused on the other CAC Incubator-related work around gateway courses.

Our next meeting is scheduled for 2 p.m. Eastern on October 23. For that meeting, we invite you to review the following:

- [Don't Talk about Implicit Bias Without Talking about Structural Racism \(Osta & Vazquez\)](#) [Equity module]
- [Do introductory courses disproportionately drive minoritized students out of STEM pathways? \(Hatfield et al., 2022\)](#) [Equity module]
- [CAC Gateway Course Factor Guide](#) – Please review this document, as time permits, and identify at least one gateway course you would like to focus on. You will also need access to the current undergraduate catalog for your institution.

Resources from the first meeting:

- Link to the [meeting slides](#)
- Link to the [recording for the 2-3pm](#) Eastern meeting
- Link to the [recording for the 3-4pm](#) Eastern meeting
- Link to the session [Padlet](#)
- Links to articles and resources:
 - [Why Increasing Student Success in STEM is Important to the U.S. and Institutions](#) (We did not have an opportunity to discuss this article in the session)
 - [American Community Survey data](#)
 - [WICHE Report](#)
 - [NSF Report](#)

We look forward to seeing you soon.
All the best,

The CAC and Ed. D. Research Team,

[Steph, Brandon, Brandy, and Rob](#)

Session 2: Follow Up Ed.D. team and Incubator participants.

Dear Equity Module and CAC Incubator participants,

Thank you for your engaged participation in this past Monday's second session and your use of the shared Padlet. Brandy and I continue to be grateful for your time and energy you share in our sessions. At the end of this message are links to the session slides, recordings, and resources.

For our remaining meeting, we will spend the first 30 minutes focusing on the Equity module related work and discussions. The second 30 minutes will be focused on the CAC Incubator-related work around gateway courses. A follow up email should be coming today or tomorrow to schedule a 1-1 meeting about these sessions with Brandy and Rob.

Our next meeting is scheduled for 2 p.m. Eastern on November 6. For that meeting, we invite you to review a longer form essay from McNair, Bensimon, and Malcom-Piqueux. It is their third chapter in *From Equity Talk to Equity Walk*, and it focuses on *using data* to make inequities experienced by different populations visible and addressable. The essay starts on page 16 of the linked document and discussion prompts will be in a Padlet and are shared in the [syllabus](#).

Using Data to Advance Equity in an Institutional Context. McNair, T. B., Bensimon, E. M., & Malcom-Piqueux, L. E. (2020). Chapter 3: Using and Communicating Data as a Tool to Advance Equity. In *From equity talk to equity walk: Expanding practitioner knowledge for racial justice in Higher Education* (pp. 53–78).

CAC Gateway Course Factor Guide – Please review this document, as time permits, and identify at least one gateway course you would like to focus on. You will also need access to the current undergraduate catalog for your institution.

Resources from the second meeting:

- Link to the [meeting #2 slides](#)
- Link to the recording meeting
- Link to the second session's [Padlet](#)

Links to articles and resources:

- [Don't Talk about Implicit Bias Without Talking about Structural Racism \(Osta & Vazquez\)](#) [Equity module]
- [Do introductory courses disproportionately drive minoritized students out of STEM pathways? \(Hatfield et al., 2022\)](#) [Equity module]

Resources from the first meeting:

- Link to the [meeting slides](#)
- Link to the recording for the 2-3pm Eastern meeting
- Link to the recording for the 3-4pm Eastern meeting
- Link to the session [Padlet](#)
- Links to articles and resources:
- [Why Increasing Student Success in STEM is Important to the U.S. and Institutions](#) (We did not have an opportunity to discuss this article in the session)

- [American Community Survey data](#)
- [WICHE Report](#)
- [NSF Report](#)

We look forward to seeing you soon next week.
All the best,

The CAC and Ed. D. Research Team,

Steph, Brandon, Brandy, and Rob

Session 3: Follow Up Ed.D. team and Incubator participants

Dear Equity Module and CAC Incubator participants,

Thank you for your engaged participation in Monday’s third synchronous session. Your shared Padlet comments, engaged conversation, and transparent questioning of how we move forward (and what does it mean to “hold ourselves accountable”) were enlightening conversations. While this is the last group meeting, we are asking for 30-60 minutes of your time for a 1-1 (you, Brandy, and me) debrief and reflection time. Brandy and I continue to be grateful for your time and energy you share in our sessions. For those that have not scheduled a time, [please follow this link to schedule a time](#).

If you have not completed the 3-question pulse survey, please [follow this link](#).

At the end of this message are links to the session slides, recordings, and resources.

And the final [post-equity module survey](#) is here.

Thank you all for your participation, engagement, and support of our work.

Resources from the third meeting:

- [Link to the meeting #3 slides](#)
- [Link to the recording meeting](#)
- [Link to the third session’s Padlet](#)
- Links to articles and resources:
 - [Using Data to Advance Equity in an Institutional Context](#).
 - Ways for operationalizing our equity values and goals: [AAAS SEA Change](#)
 - Preparing the next generation of strategic leaders: [AACU Truth, Racial Healing & Transformation](#)

Resources from the second meeting:

- [Link to the meeting #2 slides](#)
- [Link to the recording meeting](#)
- [Link to the second session’s Padlet](#)

Links to articles and resources:

- [Don't Talk about Implicit Bias Without Talking about Structural Racism \(Osta & Vazquez\)](#) [Equity module]
- [Do introductory courses disproportionately drive minoritized students out of STEM pathways? \(Hatfield et al., 2022\)](#) [Equity module]

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Links to articles and resources:

- [Why Increasing Student Success in STEM is Important to the U.S. and Institutions](#) (We did not have an opportunity to discuss this article in the session)
- [American Community Survey data](#)
- [WICHE Report](#)
- [NSF Report](#)

We look forward to seeing you soon.

All the best,

The Ed. D. Research Team

Brandy and Rob

APPENDIX H

Recruitment Email

Dear Curricular Analytics Community (CAC) Colleagues,

I hope this message finds you well. As a Curricular Analytics Community (CAC) member, I invite you to participate in a research study for the Western Carolina University Ed.D. dissertation of Brandy Bowman and Robert Rodier. The study also serves as a pilot for an equity module for the CAC, and your input will be valuable.

What: A study to measure the impact of equity-focused modules on participants' ability to recognize inequitable student outcomes resulting from course complexity.

Who: Members of the Gardner Institute's Curricular Analytics Community interested in equity-focused professional development.

Why: Enhance the focus on equity in program design and curricular complexity to improve student outcomes and success.

What do you get:

Free equity-focused professional development.

Contribute to this vital field of scholarship.

Advance equitable student outcomes through your critique and feedback.

Influence the implementation of an equity-focused lens for future CAC members.

What do we get:

Data to measure the impact of the equity modules.

Inform the content of a data-informed equity component for the CAC.

Assist Brandy and Rob in earning their Ed.D.s!

When & Where: Three synchronous online equity modules, each lasting 30 minutes, with an optional 45-minute one-on-one interview with the researchers to provide your feedback and critique. October 10, 23; November 6; December 11.

If you are interested in joining us, please reply to this email or follow this link to share your interest or complete the participant consent form linked there. We will follow up with additional information and details.

Please do not hesitate to contact us with any inquiries or concerns.

Thank you for your consideration.

Respectfully,

Brandy Bowman,
bowman@gardnerInstitute.org

Robert Rodier
rodier@gardnerInstitute.org

APPENDIX I

Pulse Survey Responses

Start Date	Did readings help increase your understanding of the topic?	How helpful is the reading's equity concept important to curricular complexity and program design?	How can the reading material or discussion be improved?	Is this work impacting your work outside of the CAC?
10/23/23	Extremely helpful	Extremely helpful		Definitely a positive impact
10/23/23	Very helpful	Extremely helpful		Definitely a positive impact
10/23/23	Very helpful	Very helpful	Provide a list of two or three questions with each one to prompt the reader to reflect on the reading.	Probably a positive impact
10/23/23	Very helpful	Extremely helpful	My research has shown how difficult it is for people to identify their own implicit biases and the work to change our thinking is challenging and can be time consuming.	Definitely a positive impact
10/23/23	Very helpful			
11/6/23	Extremely helpful	Extremely helpful		Definitely a positive impact
11/8/23	Very helpful	Very helpful	We need to the connection between the readings and complexity more explicit.	Definitely a positive impact

Pulse Survey Thematic Tables

Theme	Codes	Description	Supporting Quotes
Effectiveness of Readings	-Helpful, increased understanding -Reading quality	Participants found the readings helpful or extremely helpful in increasing their understanding of the topics	Q2: "Extremely helpful", "Very helpful"
Equity Concept in Curriculum	-Equity in curriculum -Program design -Complexity of topic	Responses indicate that the equity concept presented in the readings is crucial for understanding curricular complexity and program design	Q3: "Extremely helpful", "Very helpful"
Improvement Suggestions	-Reading improvement -Reflective questions -Identifying biases	Suggestions for improvement include providing reflective questions and making connections clearer, acknowledging the challenge in identifying biases	Q4: "Provide a list of two or three questions", "We need to the connection between the readings and complexity more explicit"
Impact on Professional Practice	-Positive impact -Application in work -CAC influence	Responses indicate participation has had a positive impact on their professional practice outside of the CAC	Q5: "Definitely a positive impact", "Probably a positive impact"

APPENDIX J

Pre-Survey (Outcome Measure)

Theme	Codes	Description	Supporting Quotes
Inclusion in Curriculum and Teaching	-Curriculum design -Teaching inclusivity -Representation in education -Bias -Culture -Community	Professors focus on including diverse perspectives and representations in their curriculum and teaching methods to promote inclusivity	"I try to be aware of the images of mathematics and who does mathematics that my students have been exposed to." (Q10)
DEI as Institutional Mission	-Institutional goals -DEI mission -Student success -Culture -Community	Respondents emphasize DEI as a critical component of their institutional mission, influencing policy and program goals	"DEI is critical to my role as the director of student success." (Q10)
Challenges in Faculty and Student Diversity	-Faculty diversity -Student body diversity -Retention challenges -Culture -Community	Discusses the challenges in achieving diversity among faculty and students, and the retention of diverse faculty members	"[Institution name] wants to create a more diverse student body... These faculty do not seem to stay long!" (Q12 response)
Perceived Influence on DEI Initiatives	-Influence on DEI -Control over diversity -Program participation -Political landscape -Power structure	Addresses the extent of control or influence respondents feel they have over the diversity of their program's participants	"I have great influence but no control." (Q13)

<p>Community and Belonging in Student Success</p>	<ul style="list-style-type: none"> -Sense of belonging -Student engagement -Community building 	<p>Highlights the importance of creating a sense of community and belonging for diverse student populations to ensure their success</p>	<p>"Student success in the math department typically flows from a sense of community." (Q11)</p>
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APPENDIX K

Participant Interview Questions

In reviewing the purpose of the module and each session, we hope to determine if the following were attained or attainable:

- The readings and discussion primed an equity lens for the causal analysis and driver diagrams when considering the implications of curricular complexity.
- The readings and discussion primed an equity lens when integrating institutional student-level program data into the curricular complexity discussions.

An equity lens is defined as a framework to identify and rectify systemic inequalities, discrimination, and barriers that may exist at an institution and its curriculum for communities of students based on their race, ethnicity, gender, first-generation and socio-economic status, the intersectionality of these characteristics, and the context of the institution and program?

1. Tell us how you define “equity” in your work?
2. Why is that important to curricular complexity? (positionality, intersectionality, challenges, opportunities, gaps, power struggles)
3. In your view, what are some of the root causes for student success challenges to Black students?
4. Why are these challenges in place?
5. What recommendations do you have for your colleagues that participate in this work?
6. Are there any resources or tools that you might find helpful in applying an equity lens to your work on curricular complexity?
7. What suggestions do you have for an equity module / primer being added to the CAC?
8. What other comments would you like to add?

APPENDIX L

Intervention Implementation Timeline

Date	Description of Event
Session #1 October 10, 2023 Zoom	<ul style="list-style-type: none"> ○ Introduction, orientation, and onboarding ○ Consent signed ○ Pre-Survey- Baseline data collection ○ Overview of Equity literature ○ In person- discussion
Session #2 October 23, 2023 Zoom	<ul style="list-style-type: none"> ○ Overview of assigned equity articles ○ Discussion board/Padlet ○ Post-session Pulse Survey
Session #3 November 6, 2023 Zoom	<ul style="list-style-type: none"> ○ Overview of assigned equity articles ○ In-person discussion ○ Post Session Pulse Survey
November 9, 2023 Zoom	<ul style="list-style-type: none"> ○ Individual interview
November 21, 2023 Zoom	<ul style="list-style-type: none"> ○ Individual interview
November 27, 2023 Zoom	<ul style="list-style-type: none"> ○ Individual interview
November 30, 2023 Zoom	<ul style="list-style-type: none"> ○ Individual interview

APPENDIX M

Discussion Boards Content

Discussion Boards:	Readings Assigned	Discussion Board Prompts	Core Themes
Session 1; Discussion Board 1	<p>ABET https://www.abet.org/why-we-need-to-address-inequities-in-stem-education</p> <p>NCES:https://nces.nsf.gov/wmpd</p> <p>American Community Survey https://data.census.gov/table/ACSDP5Y2020.DP05?q=United+States&g=010XX00US</p>	<p>How have your student demographics changed over the last 20 years?</p> <p>How has this affected your program and courses?</p> <p>Have the outcomes of your programs been affected?</p> <p>What thoughts and/or actions do you have about the ABET and NSF issues of STEM discussed in the readings?</p>	<p>Increase of black students and Latino students until COVID</p> <p>Students arrived under-prepared to become STEM majors.</p> <p>Fewer STEM majors and the quality of programs are questioned.</p> <p>Deficit language, how to shift to asset language. Case is made to increase Black and Latino students in STEM, but does not provide a pathway</p>
Session 2: Discussion Board 2	<p>Don't Talk about Implicit Bias Without Talking about Structural Racism by Kathleen Osta (@KathleenOstaNEP) and Hugh Vasquez (@HughJVasquez), National Equity Project (2019) https://www.nationalequityproject.org/articles/dont-talk-about-implicit-bias-without-talking-about-structural-racism</p> <p>Do introductory courses</p>	<p>What priming, associations, policies and assumptions contribute to the manifestation of implicit bias at your organization?</p> <p>The article argues that addressing implicit bias alone is insufficient. What are some specific strategies you have seen?</p> <p>What policies can be implemented to tackle both implicit bias and structural racism simultaneously?</p> <p>How can higher ed institutions redesign & reform their intro courses to ensure more inclusive and equitable for all</p>	<p>Lack knowledge advising leads to underrepresented student populations choosing underpaying career pathways because STEM pathways are closed to them</p> <p>Institutional Culture leads to minority</p> <p>Students in the developmental Sections</p> <p>Implicit bias- how to flip to asset-based language</p> <p>Frequent course assessments for student focus interventions</p> <p>Regular use of disaggregated data to improve student</p>

	<p>disproportionately drive minoritized students out of STEM pathways? Neil Hatfield, Nathanial Brown, Chad M Topaz <i>PNAS Nexus</i>, Volume 1, Issue 4, September 2022, pgac167, https://doi.org/10.1093/pnasnexus/pgac167</p>	<p>students? What potential strategies could be implemented to address the disparities in degree attainment highlighted in the study? How can universities support all students who struggle in introductory courses? What broader systemic changes are needed in education (K-12 and HE) to create a more diverse and inclusive workforce? How can systemic change be driven by both institutional efforts and broader societal initiatives?</p>	<p>outcomes and uncover implicit bias of faculty and institutions Talk to students regularly to improve program designs Implicit bias - disaggregated data can confirm bias Assess faculty regularly to achieve accountability Deficit Ideology of faculty, implicit bias Resources for student success- tutoring, learning assistants Professional development to increase DEI topics and awareness Financial hardships of students and families Work with communities to gather needs Institutional polices could reflect those needs</p>
<p>Sessions 3; Discussion Board 3</p>	<p>McNair, T. B., Bensimon, E. M., & Malcom-Piqueux, L. E. (2020). Chapter 3: Using and Communicating Data as a Tool to Advance Equity. In <i>From equity talk to equity walk: Expanding practitioner knowledge for racial justice in Higher Education</i> (pp. 53–78). essay, Jossey-Bass, a Wiley Brand.</p>	<p>Do we have access to disaggregated data to identify and understand how inequities show up on campus and in our spheres of influence? How does the institution hold itself accountable for being anti-racist and what metrics are used for the accounting? When we hold ourselves, our department, and our courses accountable for being anti-racist, what metrics support our work?</p>	<p>Staff and faculty do not know how to the disaggregated data, even when available Use diversity of faculty and students, and retention and graduation rates DFWI rates for students of color Race is typically avoided unless the numbers are good for a department. Goals without stated metrics or accountability. Pass rates, retention, and graduation rates by major. DFWI, retention, graduation,</p>

			<p>academic standing-- probation and suspension.</p> <p>Pushback from some faculty regarding rigor rather than looking at the disaggregated data. Assessing data in an integrated planning approach to curriculum analysis.</p>
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APPENDIX N

Thematic tables of sessions and interviews

Equity Session 1 Thematic Analysis Chart

Themes	Codes	Description	Supporting Participant Quotes
DEI Implementation Challenges	DEI challenges Political influence Legislative changes	Discussed difficulties and obstacles in implementing DEI initiatives due to political and legislative decisions	"I would say that... In Texas, you probably have heard that we are no longer supporting DEI, because of the governor's changes and other changes in the legislature." "And being a I'm just a blue girl in a red state is very difficult..."
Restrictions on DEI Language and Practices	DEI terminology Administrative restrictions Language change	Administrative decisions to avoid or restrict DEI terminology and practices	"We no longer are allowed to mention DEI as a term. So, there's a lot of changes."
Adapting to Political and Funding Constraints	Strategy adaptation Funding dependence Rebranding efforts	How institutions adapt their strategies in response to political and funding constraints, including the rebranding of DEI efforts	"We continue to do the work, but we just do not state it as DEI. we certainly continue to do that what we can internally. Even our office of DEI has been dismantled." "Honestly, I think we're still determining where that's gonna go. Right now, we're not doing anything around it."

Session Two Thematic Analysis Chart

Themes	Codes	Description	Participants' Supporting Quotes
Implicit Bias in Educational Perspectives	Implicit bias Defensive reactions Attribution of student struggles	The presence of implicit biases in educational settings, influencing perceptions of student capabilities and backgrounds	"The first gut reaction is, I don't want to be the person who caused that, right?" "What is it about their parents that makes you think, you know, what are these assumptions that we're filling in?"
Equity in Curriculum Development	Curriculum biases Program evaluation Administrative decisions	Focuses on biases in curriculum development and how certain programs or degrees are valued differently	"There's some bias about like, well, the population or the group of people that tend to go into these particular awards..." "Why do we have cosmetology still in our inventory of programs?"
Strategies for Inclusive Education	Inclusivity strategies Educational adaptation Program support	Discusses strategies for creating a more inclusive educational environment in the face of various challenges	"How do we become student ready?" "We have got to redesign our early courses, or we will have no STEM graduates."

Session Three Thematic Analysis Chart

Themes	Codes	Description	Supporting Quotes
Challenges in Curriculum Development	Curriculum development Bias in education Program evaluation Funding Language Culture	Biases in curriculum development, particularly in how certain educational programs are valued and perceived	"There's some bias about certain degrees, either staying in our inventory or deactivation of those, because the salaries may not be high enough." "We as administrators are also looking with some bias about certain degrees..."
Inclusivity and Gender Bias in Programs	Gender bias Program inclusivity Societal roles Bias/implicit bias	Gender biases and the inclusivity of certain programs, noting how societal roles influence educational offerings	"Cosmetology would also be a better area said, right, that's going to affect mostly, not all, but the majority of the students are going to be the females." "The barbering side is mostly male."
Readiness and Support for Diverse Student Populations	Student readiness Support strategies Diversity in education	Discusses strategies for supporting diverse student populations, emphasizing the need to adapt to their readiness and backgrounds	"How do we become student ready?" "Almost none of our students are prepared in the sense we might have thought of 10 years ago to succeed in a STEM field."

Thematic Analysis Chart of Interviews Summary

Theme	Codes	Description	Participants' Supporting Quotes
Equity and Accessibility	Student success Equity vs. equality Access	Focus on creating equitable conditions for student success, recognizing diverse starting points of students	"Equity to me is creating conditions in which all students can learn and thrive." "I define equity as not only access for students but also equity in the sense of making sure that the courses are built with that in mind"
Faculty Engagement and Perceptions	Faculty role Student skills Teaching methods	Importance of faculty understanding and adapting to student diversity in skills and backgrounds	"Challenging to think about... how students think about mathematics." "Faculty are assuming that all of the students have the same skill sets."
Institutional Leadership and Policy	Leadership roles Strategic planning Policy impact	The role of leadership in driving institutional policies and practices towards equity	"The State of Texas not allowing us to actually discuss [DEI] or do anything about it." "I hold myself accountable. But I will not get fired if these goals do not get met."
Curricular Analytics and Collaboration	Curricular complexity Department collaboration Systemic barriers	Utilizing curricular analytics to identify and address systemic barriers in education	"Interesting questions... about our curriculum." "I love the curricular analytics... but it's a level of like university complexity that we're not in a good place to address."
Political and Funding Challenges	Political influence Funding constraints Resource allocation	The impact of political decisions and funding limitations on equity efforts in education.	"A lot of our units have been dismantled for DEI."

Data-Driven Approaches	Data analysis Outcome measurement Disaggregation	Emphasis on data-driven strategies to understand and address equity issues	"I track how we're doing in a variety of ways, but primarily, with course outcomes, retention and four and six year graduation rates all disaggregated by race..." "Yes, we do look at disaggregated data..."
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APPENDIX O

Thematic Table for Codes

Theme	Codes
<p>Bias This theme encompasses codes related to unconscious assumptions, preferences, and the prejudicial impacts on curriculum design, teaching, and student engagement.</p>	<ul style="list-style-type: none"> • Implicit Bias • Defensive Reactions • Attribution of Student Struggles • Curriculum Biases • Bias in Education • Gender Bias • Program Inclusivity • Societal Roles • Identifying Biases
<p>Institutional Culture This theme includes codes that relate to the roles and responsibilities of state, federal, and institutional leaders, including faculty, in shaping policies, curricula, and the overall educational environment towards equity and inclusivity.</p>	<ul style="list-style-type: none"> • Faculty Role • Student Skills • Teaching Methods • Leadership Roles • Strategic Planning • Policy Impact • Department Collaboration
<p>Anti-DEI (Diversity, Equity, and Inclusion) This theme captures codes that are directly related to the implementation, challenges, and strategies of DEI in the educational context.</p>	<ul style="list-style-type: none"> • DEI Challenges • Political Influence • Legislative Changes • DEI Terminology • Administrative Restrictions • Language Change • Strategy Adaptation • Funding Dependence • Rebranding Efforts • Systemic Barriers • Funding Constraints • Resource Allocation • Student Readiness • Support Strategies • Student Success • Equity vs. Equality • Access • Curricular Complexity • Equity in Curriculum • Complexity of Topic • Diversity in Education • Inclusivity Strategies • Data Analysis • Outcome Measurement • Disaggregation

