

Acknowledging and Addressing the Achievement Gaps in Undergraduate Education

ACKNOWLEDGING AND ADDRESSING THE ACHIEVEMENT GAPS IN UNDERGRADUATE EDUCATION

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CONTENTS

Introduction	1
<u>Part I: Acknowledging Academic Achievement Gaps for Underrepresented, First-Generation, and Transfer Students</u>	
Concerns and Considerations for How to Inclusively Discuss the Achievement Gap	5
Using Terms that Are Accurate and Inclusive	7
The Racial/Ethnic Academic Achievement Gap	9
<i>Primary School (AKA Grade School)</i>	9
<i>Secondary School (AKA Middle/High School)</i>	10
<i>Postsecondary School (AKA College)</i>	10
<i>Summary of Racial/Ethnic Academic Achievement Gap</i>	11
The First-Generation and Transfer Student Achievement Gaps	12
Causes of the Achievement Gaps	14
Structural Racism	16
Colorblindness	17
Generational Wealth and Income (GWI)	18
Social-Psychological Factors: Interest, Identity, Motivation and Belonging	20
Stress, Anxiety, and Mental Health	21
<i>Who is Affected by Stress and Anxiety?</i>	21
<i>Defining Stress and Anxiety</i>	21
<i>Causes of Stress and Anxiety</i>	22
<i>Consequences of Stress and Anxiety</i>	22
Stereotype Threat	23

The Imposter Phenomenon (AKA Imposter Syndrome)	24
Mindset of Students and Faculty	25
<i>Student Mindset</i>	25
<i>Instructor Mindset</i>	25
Microaggressions	27
Implicit Bias	28
Task Assignment Bias and Intellectual Marginalization	29
First Generation Students Experience Many of the Same Problems as AHNs	30
Transfer Student Challenges	32
Intersectionality	34
Summary and Discussion	35
<i>Words That Come Before All Else</i>	35
<i>Three Groups Share Three Key Problems</i>	35
<i>Teacher Perceptions of the Academic Achievement Gap</i>	36
<i>Instructors and Administrators Can Help in Numerous Ways</i>	37
<i>Conclusion</i>	37

Part II: Addressing Academic Achievement Gaps for Underrepresented, First-Generation, and Transfer Students

Review of Part I: Achievement Gaps and Their Causes	41
<i>Achievement Gaps in Higher Education</i>	41
<i>Causes of Achievement Gaps</i>	41
Why Closing the Gap is Important	42
Parallel Approaches to Closing the Academic Achievement Gap	43

Counter Bias and Racism	45
<i>Promote Multiculturalism Instead of Colorblindness</i>	45
<i>Recognize and Reduce Implicit Bias</i>	46
<i>Asset Mapping</i>	47
<i>Countering Microaggressions with Microaffirmations</i>	47
<i>The Value Affirmation Intervention Combats Stereotype Threat</i>	48
Increase Student Belonging	49
<i>Student-Instructor Rapport and Instructor Immediacy</i>	49
<i>Using Student Names</i>	50
<i>Encouraging Participation</i>	50
<i>Group Projects Encourage Cooperation</i>	50
<i>Belongingness Intervention</i>	51
<i>Scientist Spotlight Intervention</i>	51
<i>Address the Imposter Phenomenon</i>	52
Reduce Stress and Anxiety	53
<i>General Strategies to Reduce Stress and Anxiety</i>	53
<i>Reducing Exam-Related Stress and Anxiety</i>	54
<i>Noncontent Instructor Talk and Instructor Immediacy Can Decrease Anxiety</i>	55
<i>Using Humor in the Classroom</i>	56
Improve Engagement and Performance	57
<i>Use Active Learning</i>	57
<i>Interest and Motivation</i>	58
<i>Teach and Encourage Good Studying Techniques</i>	59
<i>Goal Setting Intervention</i>	61
<i>Increasing Organization</i>	61
<i>Encourage a Growth Mindset</i>	62

Additional Strategies for FG and Transfer Students	63
<i>Helping First-Generation Students</i>	63
<i>Helping Transfer Students</i>	65
Summary and Discussion	66
<i>AHN, FG, and Transfer Students Face Many Challenges</i>	66
<i>Instructor Practices Can Reduce the Primary Drivers of the Achievement Gaps</i>	66
<i>Psychosocial Interventions Can Help Reduce the Achievement Gaps</i>	67
<i>Conclusion</i>	68
Glossary	71
References	75
About the Author	97
Back Cover	98

Academic achievement gaps are significant performance differences between any two populations of students that are not based solely on merit, but are instead based on the different life experiences of those students. These life experiences may include reduced opportunities, **bias**, stigmatization and other issues due to an individual's race, sex, socioeconomic status, religion, mental health status, disability, sexual orientation, or other aspects of identity. Many **academic achievement gaps** exist among undergraduate student populations, and all of these gaps are important. Three of the most intensively studied academic achievement gaps are those between 1) **underrepresented minority** and **White** students, 2) **first-generation** and **continuing generation** students, and 3) **transfer** and **non-transfer** students. The causes-of and solutions-to these three academic achievement gaps are the main focus of this book. This book draws extensively on peer-reviewed pedagogical literature to discuss these issues in two parts.

Part 1 of this book focuses on the causes of academic achievement gaps within undergraduate student populations. The starting circumstances and college experiences of these students creates an **unlevel playing field** that is not equitable and are not conducive to student success. Barriers and challenges that are closely associated with these intersecting student populations include structural **racism**, **colorblindness**, reduced generational wealth and income, mental health issues, **stereotype threat**, the **imposter phenomenon**, a **fixed mindset**, **microaggressions**, **implicit bias**, **intellectual marginalization**, increased family responsibilities, inadequate pre-college preparation, cultural mismatch, **transfer shock**, information overload, stigmatization, and social isolation. Collectively these challenges result in the three proximal drivers of the achievement gap 1) reduced feelings of belonging, 2) increased stress and anxiety, and 3) reduced engagement and performance. Acknowledging the reality and seriousness of these problems is essential if our goal is to allow all students to thrive and be successful.

While part Part 1 of this book focuses on the ultimate and proximal drivers of achievement gaps, Part 2 details free, readily available, evidence-based solutions to these problems. Broadly these solutions include changes to course (e.g. making a more inclusive syllabus), changes to instructor behaviors (e.g. avoiding cold-calling), and **psychosocial interventions** (e.g. the value-affirmation intervention) which have been shown to reduce achievement gaps. All of the solutions presented here require minimal class time are easy to implement in most college classrooms. By becoming aware of achievement gaps and by actively implementing solutions, instructors can begin to eliminate these gaps one course, one class session, or one student at a time.

**Real change requires both
awareness and action.**

PART I: ACKNOWLEDGING ACADEMIC ACHIEVEMENT GAPS FOR UNDERREPRESENTED, FIRST-GENERATION, AND TRANSFER STUDENTS

CONCERNS AND CONSIDERATIONS FOR HOW TO INCLUSIVELY DISCUSS THE ACHIEVEMENT GAP

Broadly speaking, the purpose of measuring achievement is to measure student learning and their progress towards their degree. Student grades are also used when students apply for jobs, scholarships, and advanced degrees. Grades and standardized test scores are therefore one of the most crucial gatekeepers for student success.

Unfortunately, metrics of achievement and standardized testing in particular may exhibit unfair **biases** towards certain groups. In his 2019 book entitled “How to Be Antiracist” Professor Ibram X. Kendi stated: “What if, all along, these well-meaning efforts at closing the achievement gap have been opening the door to racist ideas? What if different environments lead to different kinds of achievement rather than different levels of achievement?” He goes on to discuss how standardized testing originated from eugenicists and thrived upon racist ideas (Kendi, 2019). Carl Brigham, a lead developer of the SAT, believed that **Blacks** were less intelligent than **Whites**, and this was something he hoped his tests would reveal (Rosales & Walker, 2021). According to Professor Kendi, standardized tests like the SAT do not effectively measure intelligence or predict professional success, and that instead these tests have been used to exclude Blacks from prestigious schools even though it is “the tests, not the Black test-takers, [that have been] underachieving (Rosales & Walker, 2021).

Standardized testing originated from eugenicists and thrived upon racist ideas.

In addition to concerns about standardized tests, there are several other reasons to be careful when examining or reporting on achievement gaps. First, while achievement gaps are often reported between broad demographic groups, it is important to realize that each of these groups is heterogeneous and individuals within these broad categories often have different means and backgrounds (Kao & Thompson, 2003). For example, those classified as Black can come from many places within the US or from many different countries around the world, each with their own languages, cultures, and life experiences. While the broad demographic groups may be seen as underperforming or overperforming, this may mask important differences present within subgroups. Second, discussing **academic achievement gaps** is also challenging because doing so may inadvertently contribute to the association of students of color with poor academic performance, which can in turn feed into **stereotypes** and racist ideas. Lastly, there is a great temptation among scholars to refer to education as the ‘ultimate equalizer’, a panacea that can single-handedly combat racial inequality and poverty.

Education can indeed be a powerful part of the solution but treating it as a ‘silver bullet’ can inadvertently imply that existing inequalities and performance differences are based on innate differences in ability and effort rather than the larger societal problems of **racism** and unequal access to resources (Merolla & Jackson, 2019). This line of thinking can also lead to the fallacious solution of only trying to ‘fix the students’ without adjusting instructor behaviors and educational policies. For all these reasons, discussing and disseminating information about achievement gaps should be done with care and consideration towards the intended recipients and those who might be affected (Gouvea, 2021). For example, broadcasting facts about the achievement gap in a college classroom may do more harm than good, while providing these same facts to researchers, instructors, and administrators could very well be beneficial. Despite concerns about how the achievement gap is reported, measuring and discussing the academic achievement gap in STEM can be used as a powerful tool to help document equity problems and motivate change.

USING TERMS THAT ARE ACCURATE AND INCLUSIVE

When discussing the common plights of **African Americans**, **Hispanics**, **Native Americans** and other groups it is common to use shorthand labels. These labels include “**Underrepresented Minorities**” (URMs), “**People of color**” (POC), “Black, Indigenous, People of African Americans Color” (BIPOC), “Persons excluded because of ethnicity and race” (PEERs), Minoritized Groups in STEM (MGSs), and Historically Underrepresented Groups (HUGs). These terms are overlapping but are not synonymous as they often refer to somewhat different populations. The term ‘URM’ is among the most commonly used, and it is derived from the fact that although Hispanics, African Americans, and Native Americans represent ~34% of the US population, they are underrepresented among science and engineering bachelor’s degree recipients (~24%) and the science and engineering workforce (~23%) (NSF, 2017, 2019). The URM term is used by the National Science Foundation and Howard Hughes Medical

Institute, and it is still the most common term seen in the pedagogical literature. Despite the frequent usage of URM, it has been suggested that this term is problematic because 1) it was not created or supported by the groups it includes, 2) the word ‘underrepresented’ means ‘not enough’, ‘not done well’, or ‘below’ which can understandably be offensive to people labeled with this term, and 3) it clusters together many diverse groups of people in ways that can hide their different circumstances and makes it more difficult to disambiguate the data about each group (Williams, 2020). BIPOC has been adopted by several racial justice groups and it is sometimes considered to be more inclusive than

URM. While BIPOC emphasizes Black and Indigenous populations, it does not emphasize Hispanic/Latinx Americans, and it includes Asians who are comparatively high-performing in terms of academic achievement. One suggested alternative to URM and BIPOC is to use AHN, which makes use of the first letters present in African Americans/Blacks, Hispanic/Latino(a), and Native Americans/Alaskan Natives groups. The AHN term solves many of the problems with the URM acronym while also preserving the same meaning (Williams, 2020). For this reason, this review will use AHN instead of URM.

It should be noted that Asian students often perform better than all other students (including White

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students) and they have thus often been referred to as a ‘model minority’. This sobriquet is harmful however as it 1) masks important differences within the Asian student population and 2) implies other minority groups are held back simply by ability and effort and not by systemic or generational **racism** and lack of resources (Kao & Thompson, 2003). It also puts additional pressure on Asian students which can lead to increased **anxiety** and distress (Le, 2019). Consequently, the ‘model minority’ term should be avoided.

Lastly, discussions about race and equity often involve the term ‘socioeconomic status (SES)’, which refers to the amount of generational wealth and household income a person possesses. Because the word ‘status’ can refer to a person’s position, standing, or rank, saying that someone has ‘low status’ could be considered offensive. For this reason, this review will henceforth use ‘**generational wealth and household income (GWI)**’ in place of SES.

THE RACIAL/ETHNIC ACADEMIC ACHIEVEMENT GAP

The achievement gap between White students and students in minority groups has been investigated for decades using a variety of different methods and approaches. Exam score differences between Black and White students have been a particular focus of empirical research (Jencks et al., 1981; Jencks & Phillips, 1998; L. S. Miller, 1997), but much of the data obtained also has strong implications for other minority groups. Academic achievement can potentially be measured in many different ways including standardized testing, grade point averages (GPA), passing/failing rates, retention/attrition rates, and exam scores for individual classes/topics. While these metrics are not without their problems, the underlying assumption is that these metrics indicate (at least to some degree) the knowledge and abilities of students (Kao & Thompson, 2003). Although they are correlated with standardized test scores, grades are more sensitive to student input (i.e., time spent studying) and are stratified by subject areas (Fehrmann et al., 1987; Fuligni, 1997; Kao et al., 1996). Grades also inform students of their own level of proficiency and achievement within a given subject area which may affect their odds of staying in school and earning a particular degree (Fehrmann et al., 1987). Using a combination of the above metrics, researchers have investigated the achievement gap at the primary, secondary, and postsecondary school levels. Academic achievement gaps can be observed as early as kindergarten and they seem to follow underrepresented groups throughout their educational career.

Primary School (AKA Grade School)

While measuring the achievement gap can be done at any education level, historically it has mostly been done via tests given during grade school (Hertert & Teague, 2003). The closest thing to a national test that can be used for broad comparisons is the National Assessment of Educational Progress (NAEP), a battery of tests given to 4th, 8th, and 12th graders in 32 different states. These tests are frequently different between different

states and they can change over time making broad scale or long-term comparisons difficult. What is clear however is that these tests show that certain groups of children score far below children in other groups. While in primary school, AHN students do not take as many math and science courses as their White and Asian peers and the ones they do take are often less challenging (Kelly, 2009; Nord et al., 2011; NSB, 2014; Riegle-Crumb & Grodsky, 2010). This is important because academic achievement gaps within advanced courses are strongly correlated with racial/ethnic gaps seen on standardized tests (Gamoran & Mare, 1989; Kao & Thompson, 2003, 2003) and with level of interest in STEM (J. D. Miller & Kimmel, 2012; Wang, 2013).

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Secondary School (AKA Middle/High School)

The achievement gaps that are observed in primary school continue and become more entrenched as students enter secondary school. The NAEP shows that Black, Hispanic, and Native American students have typically lagged behind White students in vocabulary, reading and math (Kao & Thompson, 2003). When these students take the SAT during 11th or 12th grade the score differences are even more pronounced. For example, in 2021 the average total SAT score was 1239 for Asians, 1112 for Whites, 967 for Hispanic/Latinx, 934 for African Americans, and 927 for Native Americans (CollegeBoard, 2021). According to a 2019 survey, the high school dropout rates have also been observed to be higher for African American (5.6%), Hispanic (7.7%), and Native American (9.6%) students than they are for White (4.1%) or Asian (1.8%) students (NCES, 2021).

Postsecondary School (AKA College)

When researchers controlled for pre-college academic performance disparities, they found that **AHNs** are more likely than their White peers to both enroll in college and to declare STEM majors (Xie et al., 2015); furthermore, AHNs pursue STEM fields as often as Whites do (Xie et al., 2015). This could be due in part to the fact that AHNs are as enthusiastic about STEM education and careers as White students (NSB, 2014; Riegle-Crumb et al., 2011; Riegle-Crumb & King, 2010).

Despite high enthusiasm and enrollment, AHNs remain underrepresented in STEM education. In 2019, 36.9% of Whites had obtained a bachelor's degree or higher while the percentage was lower for Blacks (22.5%), Hispanic/Latinx (17.6%), and Native Americans (16.1%) (US Census Bureau, 2019). In addition, AHNs are disproportionately represented at community colleges which typically have poor outcomes and offer less career

opportunities than larger 4-year institutions (Brint & Karabel, 1989; Dougherty, 1994). AHNs are also more likely than White students to attend school part-time (Rumberger, 1982), and are more likely to drop out of college (Chang et al., 2014; Chen, 2015; Estrada et al., 2016; Good et al., 2000; Kalsner, 1991; Seymour & Hewitt, 1994). These effects are likely due to disparities in academic preparation as the gap is eliminated when you control for high school grades and test scores (Camburn, 1990).

Summary of Racial/Ethnic Academic Achievement Gap

Educational disparities start in kindergarten and become compounded throughout an AHN student's educational progression (Xie et al., 2015). The observed racial/ethnic achievement gap limits AHN participation, achievement (e.g., standardized test scores) and educational attainment (e.g., highest degree earned) in STEM (Xie et al., 2015). While much progress was made following the civil rights movement in the 1950s and 1960s, the progress has since stagnated and today the achievement gap is not much better than it

The achievement gap is not much better than it was in the 1970s.

was in the 1970s (Merolla & Jackson, 2019). Although many equity-focused policies have been implemented, there are still significant differences between AHN participation, scores, and grades when compared to White and Asian students (Xie et al., 2015). In K-12

settings, teachers often have lower expectations for AHN students (Tenenbaum & Ruck, 2007) with a focus on behavior and discipline rather than cultivating academic opportunities (Merolla & Jackson, 2019). AHNs continue to be underperforming and underrepresented in STEM (Chen & Soldner, 2013; NSB, 2014) and they are more likely to drop out of school than White and Asian students at primary, secondary, and postsecondary levels (Oakes, 1990; Ross, 2012).

THE FIRST-GENERATION AND TRANSFER STUDENT ACHIEVEMENT GAPS

Just as there is an academic achievement gap between AHN and White students, an achievement gap also exists between **first-generation (FG)** and **continuing-generation (CG) students**. CG students have one or two parents that have completed a 4-year college degree while FG students' parents lack 4-year college degrees. Estimates suggest that FG students make up anywhere between 15-20% of college students (Harackiewicz et al., 2014) to as much as 56% of college students (RTI International, 2019). FG students are more likely to be female, to come from low **GWI** families, and to belong to ethnic minority groups than are CG students (Nguyen & Nguyen, 2018). FG students are less likely to enroll in college (Shelton, 2011), and more likely to underperform and drop-out than CG students (Engle & Tinto, 2008). During college, FG students take fewer credits, have lower grades, and have lower scientific reasoning skills than their continuing generation peers (Shelton, 2011). The FG student achievement gap has also been called the social-class achievement gap because parental education levels are often linked to their social class or GWI (Harackiewicz et al., 2014; Snibbe & Markus, 2005). The 3-year attrition rate for FG college students (33%) is more than double that of CG students (14%) (Cataldi et al., 2018). Ultimately FG students are less likely than CG students to obtain bachelor's degrees (Shelton, 2011).

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An achievement gap also exists between transfer and non-transfer students. More than 40% of college students will transfer between institutions on their way to obtaining a degree (Townsend, 2008). Transfers can

More than 40% of college students will transfer between institutions on their way to obtaining a degree.

occur from a 2-year institution to a 4-year institution (upward or vertical transfer), between institutions of the same type (i.e., 2-year to 2-year, or 4-year to 4-year transfers, lateral transfer), or from a 4-year to a 2-year institution (reverse transfer). Transfer students generally experience less academic success than non-transfer students (Lakin & Elliott, 2016) and the

majority leave the university before obtaining their degree (Yazdani et al., 2021). Many transfer students start in community colleges where ~29% of students are FG students and ~41% are AHN students (AACCC, 2021). Out of all the students who transferred from a 2-year to a highly selective 4-year institution in the fall of 2020,

~26% were AHNs (Bobbitt et al., 2021). Together these numbers highlight the intersectionality between AHN, FG, and transfer students.

CAUSES OF THE ACHIEVEMENT GAPS

Many explanations have been proposed to explain the academic achievement gaps seen between AHN and White students, between FG and CG students, and between transfer and non-transfer students. While race and class correlate with the achievement gap data, these attributes by themselves do not suggest a satisfactory explanation for why the disparity exists. Why should it be that a poor student or an AHN student should perform worse on average than a typical affluent or White student? The reasons for achievement gap differences are many, and they are often intersecting and interdependent on each other.

As we will see below, racism and bias contribute to the development of an unlevel playing field experienced by AHN, FG, and transfer students. As mentioned above, these categories are not mutually exclusive and it is common for FG and transfer students to be students of color (Nguyen & Nguyen, 2018; Sansing-Helton et al., 2021). While AHN students experience bias because of the color of their skin, FG and transfer students also experience **stereotypes** (Croizet & Claire, 1998; Johnson et al., 2011), **cultural mismatch** (Housel & Harvey, 2010), and/or **stigmatization** (Chin-Newman & Shaw, 2013; Laanan et al., 2010; Shaw et al., 2019). Bias and racism can then either directly or indirectly lead to the three proximal drivers of the achievement gap: 1) reduced feelings of belongingness, 2) increased stress and anxiety, and 3) decreased engagement and performance (Figure 1). The primary drivers of the achievement gaps as well as their root causes will be further discussed in the paragraphs that follow.

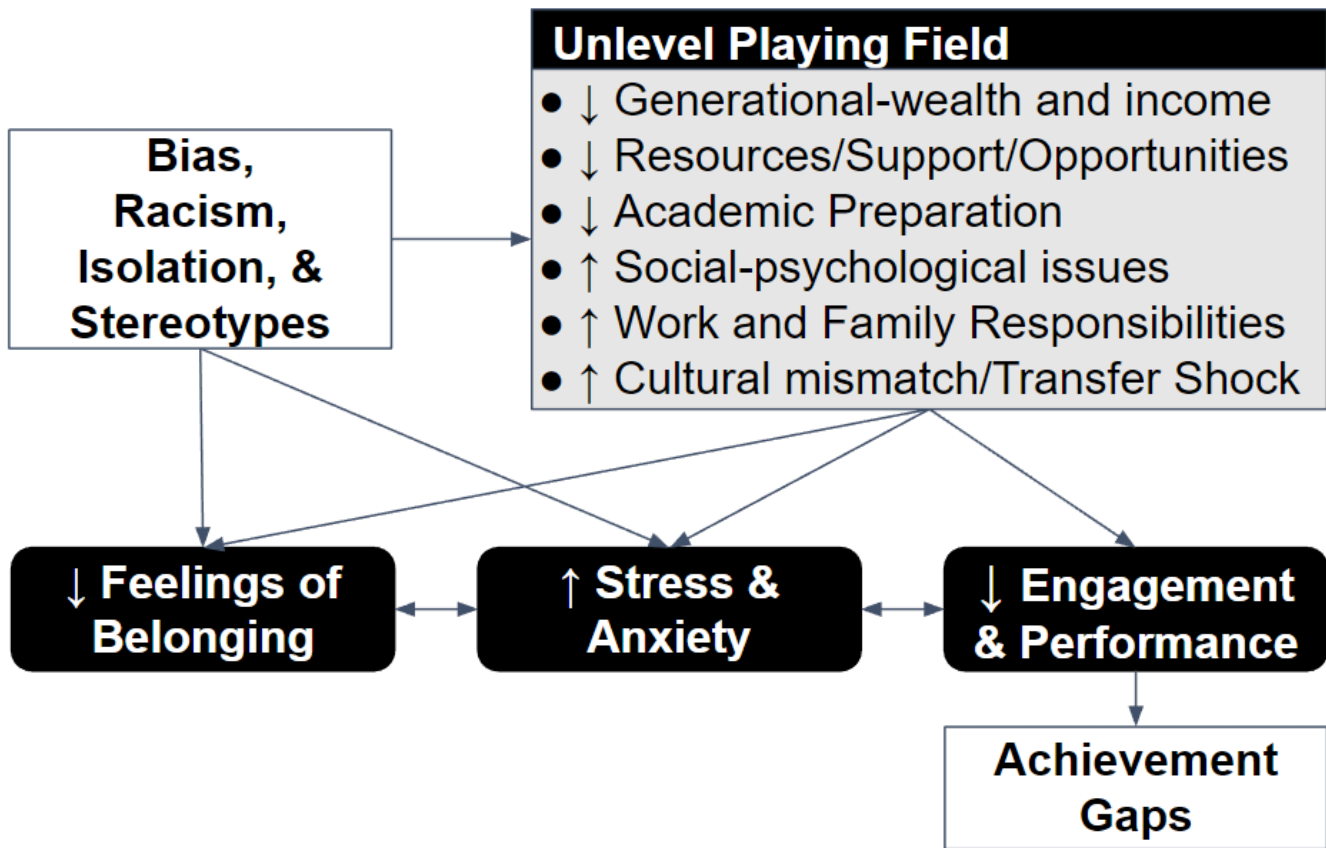


Figure 1. Primary Drivers of Academic Achievement Gaps. Bias, racism, isolation, and stereotypes in college and society contribute to the unlevel playing fields experienced by AHN, FG, and transfer students. The unlevel playing fields between AHN and White students, FG and CG students, and transfer and non-transfer students put AHN, FG, and transfer students at a distinct disadvantage. Bias and racism are the chief cause of the unlevel playing field for AHN students, while cultural mismatch and transfer shock primarily affect FG and transfer students respectively. Reduced generational-wealth and income often leads to fewer resources, less academic preparation, and increased work and family responsibilities. Bias, racism, stereotypes, isolation and unlevel playing fields directly and indirectly cause and exacerbate the three primary drivers of the achievement gap: 1) decreased feelings of belonging, 2) increased stress and anxiety, and 3) decreased engagement and performance.

STRUCTURAL RACISM

Structural racism manifests itself in nearly every aspect of society in the United States including health and medicine, financial markets, criminal justice, and the economy (Merolla & Jackson, 2019); it is also a primary cause of disparities in education (Merolla & Jackson, 2019). At the national level the Director of the CDC has recently declared racism “a serious public health threat” (Wamsley, 2021). Racism is directly or indirectly responsible for many of the other factors shown or theorized to affect the academic and career achievement gaps including **colorblindness**, **GW** gaps, **stereotype threat**, **microaggressions**, **implicit bias**, **task assignment bias**, and **intellectual marginalization**.

COLORBLINDNESS

In the United States the two most widely held ideologies regarding diversity are **colorblindness** and **multiculturalism**. These ideologies are not mutually exclusive (Stevens et al., 2008) and they both purport to reflect fairness to members of minority groups (Aragón et al., 2017). The colorblind ideology emphasizes sameness and postulates that individuals have the same opportunities and should thus be treated equally (Knowles et al., 2009). While this idea may seem like a noble sentiment, colorblindness ignores many aspects of what make people unique. By ignoring race, colorblindness is striving to solve the problems of racism and racial disparities by pretending they do not exist or are inconsequential. Colorblindness relates directly to colorblind racism, and those in the majority may use this ideology to maintain the status quo for their own benefit (Bonilla-Silva & Embrick, 2006). Colorblindness can make those in the minority feel unaccepted and undervalued (Markus et al., 2000). When instructors claim that race does not matter when minority students know that it does, it may elicit distrust (Purdie-Vaughns et al., 2008), disengagement (Plaut et al., 2009), cognitive depletion (Holoien & Shelton, 2012), and feelings of not belonging in those students (Aragón et al., 2017).

Colorblindness is striving to solve the problems of racism and racial disparities by pretending they do not exist or are inconsequential.

GENERATIONAL WEALTH AND INCOME (GWI)

Both race (Black, White, Asian etc.) and class (rich, middle-class, poor) intersect in ways that make it hard to analyze data based on one without also considering the other (Kendi, 2019). Race is a strong predictor of **GWI** and minority students are disadvantaged on most GWI indicators (e.g. income, wealth, degrees, occupational prestige etc.) (Merolla & Jackson, 2019).

Unfortunately, GWI is one of the strongest predictors of academic achievement (Hertert & Teague, 2003). Children from low-GWI households typically perform much worse on average than those from high-GWI households (Hertert & Teague, 2003). GWI can influence a variety of factors including neighborhood resources and safety, school/teacher quality, and parental practices (Kao & Thompson, 2003). Low GWI is also correlated with several risk factors including: 1) lack of high quality health care, nutrition, and housing, 2)

Black families earn about 40% less than White families, are more likely to be in poverty, and have accumulated less than a tenth of the wealth that the average White family possesses.

living in single-parent households, 3) living where English is not the primary spoken language, 4) living in high crime neighborhoods, 5) exposure to substance-abuse at a young age, 6) lack of literacy and early exposure to reading, 7) reduced access to technology (e.g., household computers, high speed internet etc.) (Hertert & Teague, 2003), and 8) increased likelihood of experiencing psychological barriers (e.g., negative self-perception, emotional distress etc.) (Jury et al.,

2017). Low GWI also exacerbates the problem of student debt, which is disproportionately high among African Americans (Fletcher, 2021). Black families earn about 40% less than White families, are more likely to be in poverty, and have accumulated less than a tenth of the wealth that the average White family possesses (Jones et al., 2018). These differences in employment, salary, and family wealth may further exacerbate the achievement gap as they mean that the parents of AHN children are likely to have less resources at their disposal than parents of White children. Together these risk factors create a synergistic effect that can significantly lower student performance and achievement.

Substantial differences in academic achievement are observed between low-GWI and high-GWI students throughout their education in STEM (J. D. Miller & Kimmel, 2012; Mulligan et al., 2012; NSB, 2014; Schneider et al., 1998). Poverty, underemployed families, reduced levels of parental education, and single-parent families are much more common among AHN students than with White or Asian students (Kao &

Thompson 2003). Poverty, which is correlated with lower levels of parental education, and which is disproportionately high among African American and Hispanic populations, is particularly likely to reduce students' academic success (Hertert & Teague, 2003; Kao & Thompson, 2003). Most White students have access to more privileges and greater access to resources of all kinds (especially financial resources), which makes it easier for them to succeed in college (Kao & Thompson 2003). In contrast, AHNs start school with fewer resources, and they accumulate resources at a slower rate (Merolla and Jackson, 2019); this early lack of resources can have a 'snowball' effect which affects each subsequent stage of education as well as future academic and career success. Intriguingly, numerous studies show that controlling for family GWI eliminates most of the racial achievement gap in science (Xie et al., 2015), supporting the idea that a low GWI is one of the prime causes of the achievement gap.

White students have access to more privileges and resources, which makes it easier for them to succeed in college.

SOCIAL-PSYCHOLOGICAL FACTORS: INTEREST, IDENTITY, MOTIVATION AND BELONGING

Social-psychological factors appear to be even more important than GWI for participation, persistence, and achievement in STEM education (Xie et al., 2015). Social-psychological factors, which are also known as non-cognitive or affective factors, include interest in science, science identity, science career aspirations, attitudes, beliefs, confidence, belonging, attention, self-discipline, self-esteem, enthusiasm, effort, responsiveness, ethnicity stigma conscious (ESC, a measure of stereotype threat), and anxiety (Farkas, 2003; Salehi et al., 2021; Xie et al., 2015). Affective qualities such as science interest, science identity, and science career aspiration are considered a prerequisite for success (Xie et al., 2015). Not surprisingly, research has also shown that students with a strong achievement motive perform better on achievement tests than less motivated students (McClelland et al., 1953). In contrast to White students, AHN students often feel isolated (Seymour & Hewitt, 2000) and have trouble adapting to the culture of science, which can reduce their confidence, engagement, and persistence (Carlone & Johnson, 2007; Chang et al., 2014), as well as prevent meaningful integration into the scientific community (Graham et al., 2013; Tinto, 1993). They also experience reduced social belonging (Seymour & Hewitt, 2000) and the imposter phenomenon (AKA imposter phenomenon, see section below) (Wilson et al., 2015). In addition, the decades of discrimination endured by African Americans and Hispanic Americans has made some of them distrustful of White society and less likely to believe that school leads to socioeconomic mobility (Kao & Thompson, 2003). Students' social-psychological factors directly relate to stress, anxiety, student feelings of belonging, stereotype threat, imposter phenomenon, and mindset which are all discussed in subsequent sections.

AHN students often feel isolated and have trouble adapting to the culture of science, which can reduce their confidence, engagement, and persistence.

STRESS, ANXIETY, AND MENTAL HEALTH

Who is Affected by Stress and Anxiety?

Stress and **anxiety** are common mental health issues that affect all college students to different degrees. University students are more likely to experience stress, anxiety, and depression than the general population (Mofatteh, 2020). In a nationwide survey, a large percentage of students indicated that both stress (40%) and anxiety (29%) impacted their academic performance (ACHA, 2019). Underrepresented students, those who speak English as a second language, and lesbian, gay, bisexual, transgender, queer/questioning, intersex, and asexual/agender (LGBTQIA) students may feel disproportionately affected by stress and anxiety, even while in active learning environments (Cooper & Brownell, 2016; Freeman et al., 2014; Mak, 2011). Furthermore, social stigma and the lack of diversity in mental health professionals make African Americans less likely than Whites to seek mental health care (De Leon, 2019).

Defining Stress and Anxiety

Stress occurs when individuals feel overwhelmed beyond their ability to cope with a particular situation, while anxiety occurs when students feel worry, nervousness, or other ambiguous feelings caused by unresolved stress (Bamber & Kraenzle Schneider, 2016; Lazarus & Folkman, 1984). Common types of anxiety include social anxiety, group work anxiety, test anxiety, and **classroom communication apprehension (CCA)** (England et

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al., 2017). CCA, the fear of being inadequate in front of professors or peers, affects about 70% of students, at least some of the time. Social anxiety, which is the fear of embarrassment in social performance situations, affects about 13% of people. Test anxiety, which involves the fear of performing poorly on exams, quizzes, or other assessments, affects about 38.5% of

students. Group work anxiety involves the fear of misleading or being misled by team members, or about some students not adequately contributing, especially on graded assignments.

Causes of Stress and Anxiety

Factors that increase the risk of stress, anxiety, and depression include reduced financial resources, reduced social interactions, concerns about adjusting to university life, having the wrong expectations about the university or a particular course, lack of a supportive social network, and lack of support from the university (Mofatteh, 2020). Belonging to an ethnic or racial minority affects a variety of factors which significantly increases the risk of stress and anxiety (Mofatteh, 2020). Pressure to succeed, the fear of failure, and the fear of negative evaluation by the instructor or their peers are primary causes of student anxiety (Downing et al., 2020). Anxiety can also be increased when instructors are aggressive or argumentative (Downing et al., 2020).

Consequences of Stress and Anxiety

Mental health issues can reduce physical, emotional, and cognitive well-being, and lower self-confidence (Boynton Health, 2021; Mofatteh, 2020). High levels of stress and anxiety are correlated with depression and illnesses (Hsu & Goldsmith, 2021). Students with high levels of stress and anxiety exhibit less persistence towards a biology major and are more likely to drop out of college (England et al., 2017, 2019; Muller et al., 2017). When stress is not properly managed it may increase the risk of being diagnosed with other mental health conditions (Boynton Health, 2021). If left untreated, mental health problems can reduce academic performance, academic integrity, graduation rates, and interpersonal relationships, and can even lead to substance abuse and suicidal thoughts (Boynton Health, 2021; Mofatteh, 2020).

Unfortunately, the stigma associated with mental health conditions is a significant barrier towards students getting the support they need; this is especially true for male students and for those belonging to ethnic minorities (Mofatteh, 2020).

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STEREOTYPE THREAT

A **stereotype** can be defined as a widely held belief about a particular group of people. Women, AHNs, transfer students, first-generation students and other groups face stereotypes in their daily lives and in the classroom. Negative stereotypes often hold that these groups lack intelligence, competence, or the ability to perform in a classroom setting (Meadows et al., 2015). For example, some negative stereotypes claim that women and AHNs possess less intelligence and competence (Meadows et al., 2015; Stoddard & Pfeifer, 2018; Wolfe et al., 2016) and that they have only been accepted into STEM programs due to policies that favor historically underrepresented groups (Meadows et al., 2015). Although demonstrably untrue, these negative stereotypes are harmful to students and can result in a phenomenon called stereotype threat.

Stereotype threat occurs when students are conscious of stereotypes about their social group (Brown & Pinel, 2003; Hess et al., 2009) and either believe these stereotypes are true (Schmader et al., 2004), or fear their actions might inadvertently confirm and perpetuate negative stereotypes about their group (Steele & Aronson, 1995). Those with low self-esteem have been shown to be particularly vulnerable to stereotype threat (Rydell & Boucher, 2010). Stereotype threat is most commonly induced during stressful activities such as taking an exam (Beilock, 2008). Ability and performance stereotypes that AHNs face affect students in multiple ways. Some may give in to the stereotypes (i.e., “if women aren’t good at math, then what’s the point in trying?”). Others may feel apprehension, pressure, and stress about the necessity of overcoming and disproving these stereotypes (Steele, 1997). This pressure to perform may increase anxiety while simultaneously decreasing performance, and achievement (Hsu & Goldsmith, 2021). The negative effects on performance and achievement occur because stereotype threat decreases working memory (Rydell et al., 2014; Schmader & Johns, 2003) and causes hypervigilance (Forbes et al., 2008), both of which distract students when they perform important tasks. Hundreds of experiments have shown that people perform worse when they believe that the test is diagnostic of ability or when they are experiencing any type of stereotype threat (Steele et al., 2002; Steele & Aronson, 1995; Walton & Spencer, 2009). In both instances the stereotypes can cause students to become stressed and unmotivated, which may cause them to underperform in ways that exacerbate achievement gaps.

Stereotype threat decreases working memory and causes hypervigilance, both of which distract students when they perform important tasks.

THE IMPOSTER PHENOMENON (AKA IMPOSTER SYNDROME)

While **stereotype threat** makes individuals feel that they must prove that they belong, the **imposter phenomenon** makes individuals feel that they do not belong (Edwards, 2019). The imposter phenomenon occurs when high-achieving individuals fail to internalize their success and accomplishments, have self-doubt that they belong where they are, and fear being exposed as an imposter (Kolligian Jr. & Sternberg, 1991). Even incredibly successful people such as Maya Angelou, Albert Einstein, Tom Hanks, Michelle Obama, and John Steinbeck have reported experiencing some level of the imposter phenomenon (Shankar & Cokley, 2021). People experiencing the imposter phenomenon perceive that their successes are due to external factors (i.e. luck, getting help from others etc.) while they view their failures as evidence that they do not belong in their current position. While it can be experienced by anyone, the imposter phenomenon appears to be more common in FG students (Peteet et al., 2015), women, and racial minorities (Bravata et al., 2020), when compared with White male continuing generation students. Importantly, many of those with imposter syndrome also struggle with depression, anxiety, low self-esteem, psychological distress, and/or survival guilt (Cokley et al., 2017). Minority and first-generation students may be predisposed to imposter syndrome due to financial concerns, discrimination, and negative stereotypes (Ewing et al., 1996). Those with imposter syndrome may even come to resent their peers who seem to be doing better than themselves (Cokley et al., 2013). Students with imposter syndrome are anxious about their academic performance and fear being harshly evaluated or judged by their professors, both of which lead to increased pressure and reduced confidence (Chapman, 2017). Many of those experiencing imposter syndrome feel isolated and that their experiences are unique (Matthews & Clance, 1985). Even those who know they have imposter syndrome and understand what it is may continue to experience its effects (Edwards, 2019).

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MINDSET OF STUDENTS AND FACULTY

A person's mindset can affect their beliefs, including whether they believe intelligence is fixed or malleable. Those with a **fixed mindset** belief about intelligence subscribe to the idea that intelligence is just something you are born with and it cannot be increased or developed (Claro et al., 2016; Dweck, 2000). In contrast, those who have a **growth mindset** believe that people can increase their intelligence with effort and practice. While it is common to ascribe each individual as having a fixed or a growth mindset, in actuality there exists a continuum between fixed and growth mindsets and people may find themselves at different points on the continuum at different times (Yeager & Dweck, 2020). Mindsets of both students and faculty can affect students' academic performance.

Student Mindset

Multiple large-scale studies which have between tens-of-thousands and hundreds-of-thousands of student participants found sizable correlations between having a growth mindset and higher academic performance (Yeager & Dweck, 2020). One study which recruited 555,458 participants from 74 different nations found that a growth mindset was positively correlated with academic achievement in 72 out of the 74 nations that were

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surveyed (OECD, 2019). Students who adopt a growth mindset are more likely to overcome challenges, strive for improvement, achieve high grades and test scores, and exhibit resilience, while those with a fixed mindset are more likely to avoid challenges, have lower academic achievement, and exhibit helplessness in challenging circumstances (Blackwell et

al., 2007; Dweck & Yeager, 2019; Yeager et al., 2019). The association between mindset and academic performance is strongest for those who are struggling or are facing academic difficulties (Claro et al., 2016; Yeager & Dweck, 2020). A person's mindset also is associated with a person's mental health and wellbeing (Burnette et al., 2020) and associations between fixed mindset beliefs and the "fear of failure" may be a precursor to mental health issues or psychological distress (Yeager & Dweck, 2020).

Instructor Mindset

While growth mindset professors tend to encourage students and teach them improved studying or problem-

solving strategies, fixed mindset professors often view their classes as ‘filter-classes’ meant to ‘weed-out’ the ‘bad’ students. Fixed mindset professors also may encourage students to drop a course or tell them that ‘not everyone is meant for a science career’ after they perform poorly on a single exam. A 2019 study that examined the performance of 15,000 undergraduate students concluded that AHN students in classrooms with fixed mindset instructors had lower course performance and were also less motivated to do their best work (Canning et al., 2019). Faculty fixed mindset beliefs appear to be especially detrimental to the performance of AHN students (Canning et al., 2019).

MICROAGGRESSIONS

Microaggressions are short, often subtle, statements or actions that disparage others based on their background, appearance, personal characteristics, or perceived association with a marginalized group (Harrison & Tanner, 2018). When people speak negatively about students' identities it can elevate their levels of stress and anxiety and can make them feel unwelcome (Harrison & Tanner, 2018). In his seminal book "How to Be Antiracist" Professor Ibram X. Kendi emphasizes that there is nothing 'micro' about these actions and thus prefers the term 'abuse' as being more descriptive of the "distress, anger, worry, depression, anxiety, pain, fatigue, and suicide" that is being experienced (Kendi, 2019). Microaggressions are usually verbal, but they can also take on many nonverbal forms expressed through actions or body language. Non-verbal forms of microaggressions could include sitting as far as possible from minorities or securing your wallet, purse, or backpack when a person of color enters the classroom.

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Microaggressions can be broadly divided into three types: microassaults, microinsults, and microinvalidations (Sue, 2010). Microassaults occur when an individual deliberately expresses biased attitudes, beliefs or behaviors about marginalized groups. In contrast, the perpetrator of microinsults unconsciously expresses rudeness, insensitivity, or stereotypes towards a person's identity. Microinvalidations occur when an individual seeks to dismiss or negate the feelings, thoughts, and experiences of certain groups in ways that suggest that the perpetrator understands another person's feelings and experiences better than the affected person does. Instructors who practice colorblindness and attempt to 'not see color' can inadvertently commit microinvalidations when they deny that race is having an effect in the class. Microinvalidations are likely to be even more damaging when they come from someone from within the very group being targeted (e.g., a female student telling her classmates that "girls just are not good at math") (Harrison & Tanner, 2018).

Frequent microaggressions can cause harm to a student's success and sense of wellbeing. They can be very distracting and take lots of cognitive effort as students attempt to 1) determine whether a microaggression has in fact occurred and 2) whether and how they should respond. Aside from being a stressful situation, microaggressions can also trigger stereotype threat (Harrison & Tanner, 2018).

IMPLICIT BIAS

In contrast to the explicit bias of structural **racism**, **implicit bias** refers to unconscious attitudes, beliefs, or stereotypes that can involuntarily affect our actions, decisions, or thoughts about certain groups (Staats et al., 2017). Everyone has implicit biases that are based on our background, experiences, and media exposure (Staats

Implicit biases may directly oppose your own explicit beliefs about fairness and equity and may even be against your own self interest.

et al., 2017). Harboring implicit biases does not make you a good or bad person, but acting on biases based on inaccurate associations, information, or stereotypes can create barriers to equity and opportunity that have harmful, real-world effects (Staats et al., 2017). Because they are unconscious, implicit biases may directly oppose your own explicit beliefs about fairness and equity and may even be against your own self interest

(Staats et al., 2017). People are most susceptible to implicit biases when they are stressed, fatigued, or experiencing a high cognitive load (e.g. time pressure, distractions, etc.) (Staats et al., 2017).

Despite their unconscious nature, implicit biases affect many aspects of society and play roles in policing, immigration, healthcare, and education (Staats et al., 2017). For example, implicit biases can cause instructors to view Black students as being less academically prepared and less accepted by their peers; instructors may also implicitly associate Black male students with aggression, violence, and criminality, which may lead them to invoke stronger disciplinary measures than they would against White students (Staats et al., 2017). Implicit biases have also been shown to have negative impacts on academic assessments and recommendation letters for Black students (Carbado et al., 2016; Jacoby-Senghor et al., 2016). Implicit biases may also make it more difficult for AHNs to get into college. One study found that when students emailed potential advisors to see if they were a good fit for the program, these potential mentors were more likely to respond positively to White males than to all other groups regardless of their own race, gender, and ethnicity (Kirwan Institute, 2018; Milkman et al., 2014).

TASK ASSIGNMENT BIAS AND INTELLECTUAL MARGINALIZATION

Women and students of color may experience **intellectual marginalization** and/or **task assignment bias** while working on teams (Meadows et al., 2015). Intellectual marginalization occurs when the ideas of marginalized groups are ignored. Task assignment bias, which occurs when students assign tasks to themselves or others, can result in women and students of color being assigned tasks that are less considered valuable or desirable. For example, a woman on the team may be assigned a secretarial role rather than a role in project research or leadership. Ideas generated by White male students are frequently given priority, while ideas expressed by women and students of color may not be written down or considered (Stoddard & Pfeifer, 2018). One of the effects of intellectual marginalization is that some AHN students feel they must work harder than their teammates in order to overcome stereotypes (Meadows et al., 2015).

FIRST GENERATION STUDENTS EXPERIENCE MANY OF THE SAME PROBLEMS AS AHNS

Many **FG** students feel they lack the necessary content knowledge, financial knowledge, and study skills to be successful in college (Engle et al., 2006). Both before and after entering college, FG students face numerous challenges which impact their academic success. Pre-college factors that affect FG student success include poverty, high school quality, high school rigor, and parenting practices (Harackiewicz et al., 2014). FG students

FG students in general have less academic preparation, take fewer advanced courses and more remedial courses in high school, have a lower high school GPA, and exhibit lower ACT and SAT scores.

in general have less academic preparation, take fewer advanced courses and more remedial courses in high school, have a lower high school GPA, and exhibit lower ACT and SAT scores (Atherton, 2014; Shelton, 2011). The parents of FG students often have only a high school education or less, so they are often unable to provide sufficient social and academic guidance that FG students need to be successful (Shelton, 2011). Furthermore, FG students have only limited

information about how to apply-to and pay-for college (Shelton, 2011).

Once they enter college, FG students face additional challenges including **stereotypes** (Croizet & Claire, 1998; Johnson et al., 2011), educational persistence issues (Shelton, 2011), and mismatches of cultural values (Housel & Harvey, 2010). FG students are generally less integrated into campus culture and are therefore less likely to participate in study groups, office hours, meetings with advisers, on-campus social groups, and recreational or other extracurricular activities (Shelton, 2011). One reason for this is that FG students are less likely to feel that they fit in and more likely to have a **cultural mismatch** with the culture of their college. When a cultural mismatch occurs in FG students, it may cause them to view their peers and college as unfamiliar, uncomfortable, and difficult. This mismatch is exacerbated by the fact that they tend to be older than their peers and tend to live off campus (Shelton, 2011). Overall feelings of cultural mismatch can reduce FG student engagement with peers and instructors (Pike & Kuh, 2021; Terenzini et al., 1996), increase their stress levels and negative emotions (Stephens et al., 2012), and lead to lower performance,

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persistence, achievement, and feelings of belongingness (Harackiewicz et al., 2014; Housel & Harvey, 2010; Stephens et al., 2014). FG students are more likely to have greater work and family responsibilities, and are more likely to feel guilty about leaving their work or families to obtain a degree (Goldman et al., 2022). The difficulty in splitting time between work, academic, and family priorities can lead to added stress and hectic schedules (Shelton, 2011). The social pressures and personal insecurities faced by FG students mean that they need additional emotional and material support (Shelton, 2011). Compared to CG students, FG students typically exhibit lower self-efficacy (i.e., their belief they can do what is necessary to succeed) (Ramos-Sánchez & Nichols, 2007), higher levels of stress and depression (Stebbleton et al., 2014), and they believe that high amounts of effort and resources are required from them to be successful (Goldman et al., 2022). Despite these concerns, FG students are less likely than CG students to take advantage of college resources such as counseling services (Stebbleton et al., 2014).

TRANSFER STUDENT CHALLENGES

Like **FG** students, **transfer students** are also typically older than **non-transfer students** and spend more hours per week working and caring for dependents (Kuh, 2003). Compared to first-time freshmen, transfer students typically receive only modest support and do not participate in campus activities designed to engage new students (Thomas et al., 2021). One reason for the decreased academic performance and greater attrition observed in transfer students is the phenomenon of “transitional trauma” or “transfer shock” (Hills, 1965; Lakin & Elliott, 2016). Transfer shock refers to the difficulty transfer students have in adapting to university culture, norms, and expectations, and these challenges frequently cause an initial dip in transfer student GPA and their ability to succeed (Laanan, 2001). Transfer shock is usually greater for those transferring to a university from a community college (McGuire & Belcheir, 2013) and it occurs most strongly during the first term at the University. Causes of transfer shock include ineffective institution-provided guidance regarding STEM degree pathways and which credits will transfer (Chin-Newman & Shaw, 2013; Packard & Jeffers, 2013), poor academic preparation, unfamiliarity with university academic expectations, and difficulties establishing social networks; Inadequate academic preparation is one of the primary reasons that students leave college (Daley, 2010; Stinebrickner & Steinebrickner, 2014). Collectively these factors can leave transfer students feeling discouraged and unwelcome which can result in declines in their retention (NASEM, 2016; Reyes, 2011; Seymour & Hewitt, 2000; Thomas et al., 2021).

Transfer shock refers to the difficulty transfer students have in adapting to university culture, norms, and expectations, and these challenges frequently cause an initial dip in transfer student GPA and their ability to succeed.

While at the university, transfer students experience information overload, stigmatization, and reduced feelings of connectivity. When transfer students first start, they are inundated with a plethora of information about tuition, financial aid, geographic factors, and degree programs which can be quite overwhelming (Chin-Newman & Shaw, 2013). Transfer students can also feel overwhelmed by the sheer number of university-related emails they receive, which may cause them to stop checking them (Foster et al., 2020). Transfer students are often stigmatized because they are “late comers to science”, or because the community colleges they come from are viewed as being less rigorous than four-year institutions (Chin-Newman & Shaw, 2013; Laanan et al.,

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2010; Shaw et al., 2019). Transfer students are also less likely than non-transfer students to be involved in cocurricular activities (e.g., community service, internships, study abroad programs etc.) and student organizations (Ishitani & McKittrick, 2010), and are less likely to interact with peers and instructors (Terris, 2009). This may be because transfer students miss the bonding activities and social clique formation that usually happen during the first year (A. Miller, 2013).

Older transfer students have also been shown to be less likely to interact with younger students and less likely to participate in out-of-class learning experiences (Allen & Zhang, 2016). Overall, these reduced interactions lead to feelings of isolation (Jacobson et al., 2017), and can result in a reduced pace of progress through college (D’Amico et al., 2014; Thomas et al., 2021). Reduced participation and feelings of not being connected to the university are both risk factors for attrition (Fink et al., 2016); consequently, only 17% of transfer students obtain a bachelor’s degree (Jenkins & Fink, 2015).

INTERSECTIONALITY

Intersectionality describes how all aspects of an individual's identity (i.e., class, race, gender, religion, sexual orientation etc.) are meaningful and worthy of consideration when trying to understand a given person's experiences and challenges (Cho et al., 2013; K. Crenshaw, 1991). Many identities are associated with additional inequities or challenges and those challenges may be compounded in individuals with multiple

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overlapping identities (K. W. Crenshaw, 1989).

Consider that having one disadvantaged identity is a bit like trying to cross a busy street, while having multiple such identities would be like trying to cross an intersection where two or more busy roads meet. For example, a disabled first-generation transgender woman of low GWI is almost certain to face more challenges and barriers than most first-generation students. Likewise, an African American woman who

experiences both racism and sexism will have much different experiences than her White male peers (NCSES, 2021).

The intersectionality field has primarily explored intersections of race, social class, gender, and sexual orientation (Nichols & Stahl, 2019). The present review discusses some multiply-disadvantaged identities which are frequently co-incident (e.g. first generation students are frequently racial minorities) where data is available, but a complete analysis is not possible as most of the pedagogical literature focuses on one or two aspects of a person's identity in order to simplify data-driven research (Naylor et al., 2016).

That said, instructors would do well to remember that their students may have multiple identities, some obvious and others hidden, which may impact how those students are affected by certain comments, conversations, and coursework.

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SUMMARY AND DISCUSSION

Words That Come Before All Else

In the Onondaga Nation the school week begins with a recitation of the traditional Haudenosaunee (Iroquois) “Words That Come Before All Else”, an address that is older than the English language and which shows respect and gratitude to all elements of the natural world (Kimmerer, 2020). One part is particularly salient to instructors: “We gather our minds to greet and thank the enlightened Teachers who have come to help throughout the ages. When we forget how to live in harmony, they remind us of the way we were instructed to live as people. With one mind, we send greetings and thanks to these caring Teachers.” Indeed, these words should come before all else for instructors as one of our primary roles is to make sure everyone in the classroom lives in harmony and feels respected and appreciated.

Three Groups Share Three Key Problems

AHNs, FG students, and transfer students face a multitude of challenges before entering college and during their college career. For AHNs, structural racism, low GWI, and social-psychological factors are the root causes

Collectively bias, racism, isolation, stereotypes and the unlevel playing field experienced by AHN, FG, and transfer students culminate in the three proximal causes of the achievement gap: 1) lack of belonging, 2) increased stress and anxiety, and 3) poor engagement and performance.

of the academic achievement gap. Structural racism can lead to stereotype threat, microaggressions, and implicit bias, which can reduce students’ performance and feelings of belongingness while simultaneously increasing their levels of stress and anxiety. The low GWI experienced by many AHNs can lead to fewer resources and less academic preparation. Like AHNs, FG students and transfer students can feel isolated and overwhelmed. They often have increased family and work responsibilities and have trouble fitting in and adapting to college due to cultural mismatch and transfer shock. Collectively bias, racism, isolation,

stereotypes and the unlevel playing field experienced by AHN, FG, and transfer students culminate in the three proximal causes of the achievement gap: 1) lack of belonging, 2) increased stress and anxiety, and 3) poor engagement and performance.

None of the above challenges are the fault of the students. Instead, these challenges result from racism,

inadequate support, exclusive instructional practices, and inequitable policies. Peer-reviewed journal articles detailing these challenges and barriers are individually comprehensive and compelling, and collectively they present a strong argument that something must be done if our goal is for all students to be successful. Practically speaking, underprivileged, underrepresented, and underprepared groups are a big asset for the US and improving their STEM education experiences is paramount for maintaining the pace of scientific progress. More importantly, instructors have a moral and ethical obligation to help all their students succeed so that they can reach their educational goals and career aspirations; improving educational experiences and outcomes for these groups is simply the right thing to do.

Teacher Perceptions of the Academic Achievement Gap

Do teachers believe that the academic achievement gaps exist and are serious? Who or what do they think is responsible for these gaps? How do they view their role in addressing these problems? These very questions were the subject of Ratcliff's 2016 article entitled "Causes of and Solutions to the Achievement Gap: Teachers' Perceptions" (Ratcliff et al., 2016). This article surveyed 874 educators, most of whom were secondary school teachers. The results indicated that teachers feel that the academic achievement gap is the most important issue facing educators. Most teachers believed the academic achievement gap is largely due to non-academic factors such as parenting techniques, disruptive/inappropriate student behavior, lack of student motivation/work-ethic, and low family income. When asked to propose solutions for the achievement gap, teachers suggested reducing class size, making students more accountable, having additional tutoring opportunities, and using alternative assessments to identify high-risk students. Taken together these results show that teachers (at least secondary school teachers) feel that the primary causes-of and solutions-to the achievement gap are largely outside of their control. It is human nature to avoid blame and extra work, but this review article as well as its companion article mentioned below strongly argue that there are in fact many ways that instructors can acknowledge and address the achievement gap within their classrooms. Teachers should not view themselves as a cause of the achievement gap, or a passive bystander; instead they should see themselves as a catalyst for change. According to Ratcliff et al., "for schools to have a positive impact on closing the achievement gap, teachers must believe that they are part of the solution."

Teachers should not view themselves as a cause of the achievement gap, or a passive bystander; instead they should see themselves as a catalyst for change.

Instructors and Administrators Can Help in Numerous Ways

While instructors cannot single-handedly reverse decades of inequality and racism, college professors are ideally positioned to be an important part of the solution. Instructors can help students by altering their own behaviors and instructional practices, and by implementing psychosocial interventions or other activities designed to address the three primary drivers of the achievement gap. These strategies, interventions, and activities work by recognizing, reducing, and eliminating barriers and by implementing evidence-based practices and strategies to help students succeed; furthermore, these strategies are free and easily adapted to fit the needs of each instructor's classroom. For a detailed review, please see Part II of this book. Instructors do not need to implement all these techniques at once and are instead advised to start with simple changes such as adding inclusive language in their syllabus, improving student-instructor rapport, creating a welcoming classroom environment, and showing concern for student well-being.

Each institution should focus its efforts on challenges/barriers that are most prevalent in their student population in order to maximize the effectiveness of the interventions they choose to undertake. For example, an institution that has high amounts of transfer students may want to consider implementing programs designed to reduce transfer shock. An analysis of student demographics as well as college- or instructor-administered surveys can help determine which problems are most pressing and which students have the greatest need for support. Administrators are well positioned to increase the incentives for instructors to make meaningful changes in their classrooms. These incentives could potentially include pay raises, extra TAs, and sabbatical time, as well as having successful classroom interventions count towards promotion and tenure.

Conclusion

In conclusion, AHN, FG, and transfer students frequently experience bias, racism, and isolation, and they begin college on an unlevel playing field. These challenges decrease feelings of belongingness, increase stress and anxiety, and decrease engagement and performance, which ultimately leads to the formation of academic achievement gaps between these students and their peers. The up-hill battle these students are facing will only

Change begins with individual instructors and administrators who acknowledge both the existence and severity of the academic achievement gaps, and are willing to work towards solutions.

improve with change, and that change begins with individual instructors and administrators who acknowledge both the existence and severity of the academic achievement gaps, and are willing to work towards solutions using both novel and well-established strategies. By undertaking appropriate measures and interventions in their classrooms instructors can help lay the foundation for a more just, inclusive, and equitable future.

PART II: ADDRESSING ACADEMIC ACHIEVEMENT GAPS FOR UNDERREPRESENTED, FIRST-GENERATION, AND TRANSFER STUDENTS

REVIEW OF PART I: ACHIEVEMENT GAPS AND THEIR CAUSES

Achievement Gaps in Higher Education

An **achievement gap** is a consistent pattern of performance differences between any two groups of students. Historically ‘the achievement gap’ primarily referred to the performance difference between White and Black students, or between White students and underrepresented minorities (URMs) such as African American, Hispanic/Latinx, and Native American (AHN) students. Used more broadly the term ‘achievement gap’ can also be used to describe performance differences between first-generation (FG) and continuing-generation (CG) students, or between transfer and non-transfer students. This book will collectively refer to all of these performance differences as ‘achievement gaps’.

Causes of Achievement Gaps

AHN, **FG**, and **transfer students** experience many challenges while in higher education. These challenges are described in detail in Part I of this book. Briefly, structural **racism** (Merolla & Jackson, 2019), **bias** (Staats et al., 2017), social isolation (Jacobson et al., 2017), and **stereotypes** (Meadows et al., 2015) have led to underrepresentation, reduced **generational wealth and income (GWI)** (Hertert & Teague, 2003), inadequate support (Mofatteh, 2020), reduced opportunities (Merolla & Jackson, 2019), an increased prevalence of **social-psychological factors** (Xie et al., 2015) (e.g., **stereotype threat**, the **imposter phenomenon** etc.), and an **unlevel playing field** (Alhindi, 2020; Goldhaber et al., 2015). **Colorblindness** (Markus et al., 2000), **microaggressions** (Harrison & Tanner, 2018), and a **fixed mindset** (Yeager & Dweck, 2020) in both students and faculty all contribute to and exacerbate the issues. FG and transfer students are also burdened with the additional problems of **transfer shock**, information overload, **cultural mismatch**, and increased family responsibilities (Chin-Newman & Shaw, 2013; Laanan, 2001; Shelton, 2011). Ultimately these underlying problems contribute to academic achievement gaps by 1) reducing feelings of belongingness, 2) increasing stress and anxiety, and 3) reducing engagement and performance. These formidable challenges are inextricably linked, and they often reinforce one another; for example, it is easy to imagine how a student who experiences a high degree of bias might be less likely to feel that they belong in the classroom, which could lead to increased stress and anxiety, and concomitant declines in both engagement and performance.

WHY CLOSING THE GAP IS IMPORTANT

Underrepresented and disadvantaged minorities are the fastest growing part of the U.S. population and are one of our biggest assets; improving STEM education for these groups to create a robust science and engineering workforce is essential if we are to maintain scientific and economic progress (Hrabowski, 2011; Xie et al., 2015). Unfortunately, STEM fields lack a sufficient number of trained professionals, and this gap is related to insufficient opportunities for FG and AHN students (Hrabowski, 2011; Institute of Medicine, 2007).

While the challenge may seem daunting, there are plenty of reasons to be optimistic. Over the last several decades higher education institutions have increased science participation and narrowed achievement and attainment gaps for women and many historically underrepresented racial and ethnic minorities (e.g., AHNs.) (Kao & Thompson, 2003; NCSES, 2021). It is also encouraging that underprivileged young people have universally high educational aspirations and most expect to go to college (Kao & Thompson, 2003).

The links between academic performance, degree attainment, career success, and disadvantages faced by these groups are well known (Coleman, 1961; Jencks et al., 1981). Reducing the academic achievement gaps is of paramount importance towards training and retaining students as poor performance in introductory STEM courses is the primary reason that students drop-out of college or switch to non-STEM majors (Theobald et al., 2020). College instructors may be ideally positioned to ameliorate future achievement gaps by undertaking appropriate measures and interventions in their classrooms. Instructors can increase AHN participation in science by recognizing, reducing, and eliminating barriers AHN students face in their undergraduate courses (Gibbs & Marsteller, 2016).

Reducing the academic achievement gaps is of paramount importance towards training and retaining students as poor performance in introductory STEM courses is the primary reason that students drop-out of college or switch to non-STEM majors.

PARALLEL APPROACHES TO CLOSING THE ACADEMIC ACHIEVEMENT GAP

Academic achievement gaps have numerous and interrelated causes. Methods to close these gaps are also numerous and interrelated. For example, a strategy that improves a student's sense of belonging may also simultaneously reduce anxiety and improve performance. It is recommended that instructors introduce only

While instructors need not simultaneously use every strategy and intervention listed below in their classrooms, they are encouraged to ultimately adopt and use several of these strategies in parallel in order to have the greatest effect on closing the academic achievement gaps.

one or two new strategies into their courses at a time.

While instructors need not simultaneously use every strategy and intervention listed below in their classrooms, they are encouraged to ultimately adopt and use several of these strategies in parallel in order to have the greatest effect on closing the academic achievement gaps. I have organized these strategies into four broad categories based on where they have the largest impact (Figure 2A). The first category, countering bias and racism, targets one of the root causes of the academic achievement gap. The next three categories of strategies and solutions target the proximal causes of the academic achievement gaps by

1) increasing student belonging, 2) reducing stress and anxiety, and 3) improving academic engagement and performance. While these broad strategies focus on **AHN** students, they are also likely to help **FG** and **transfer students** due to high intersectionality between these groups, as well as the similar challenges these groups face. That said, a separate section containing additional strategies that can help specifically FG and transfer students can be found near the end of this review (Figure 2B).

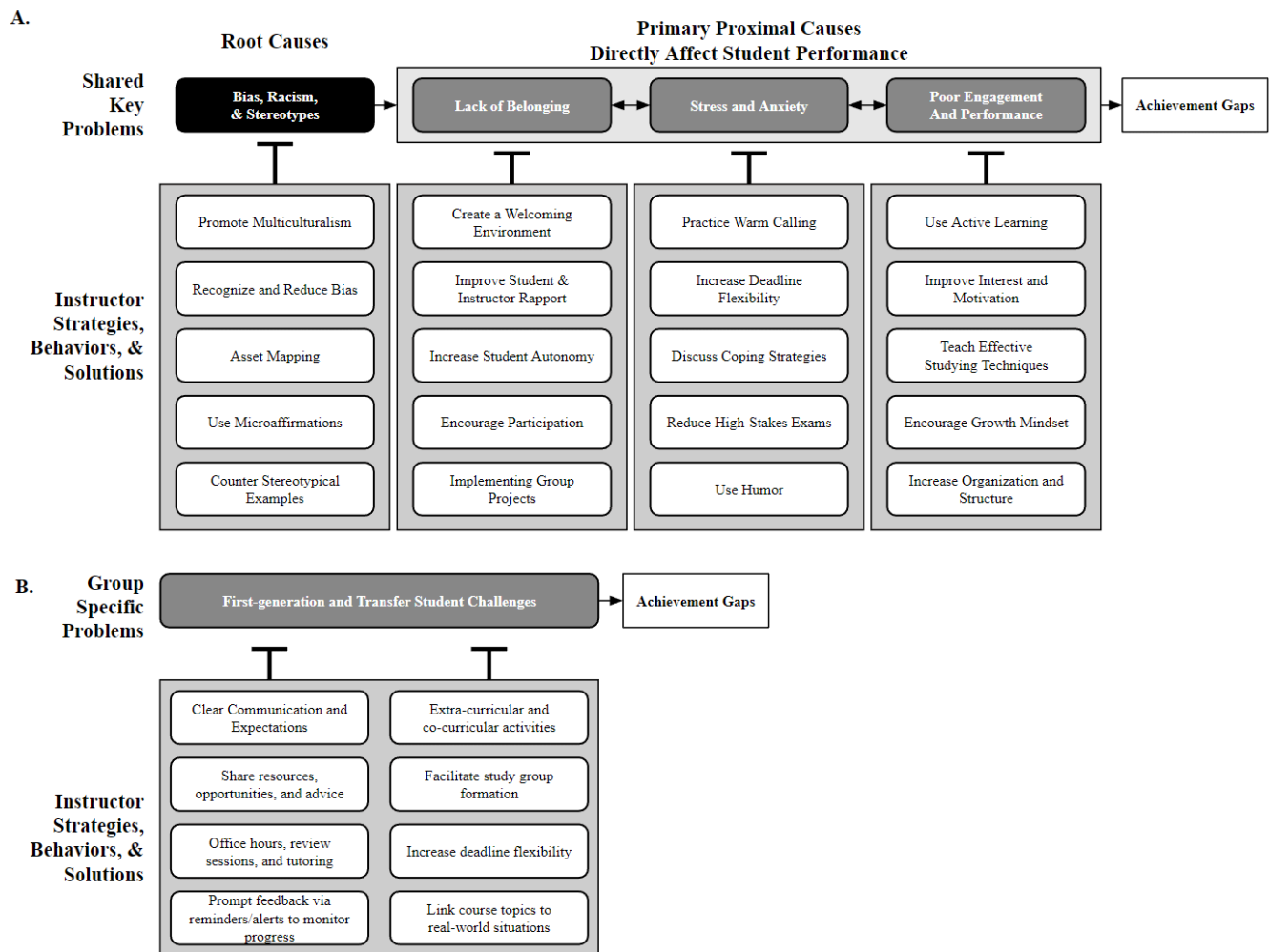
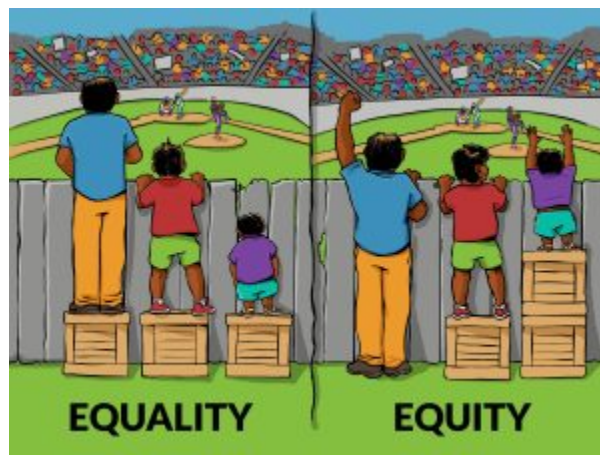


Figure 2. Summary of the Causes-of and Solutions-to the Academic Achievement Gap. A) Shared root and proximal causes of the achievement gap that affect AHN, FG, and transfer students. Solutions are shown below the problem they most directly affect. B) Details solutions that are especially important for FG and transfer students.

COUNTER BIAS AND RACISM

Promote Multiculturalism Instead of Colorblindness

In contrast to **colorblindness**, **multiculturalism** views racial, ethnic, and cultural differences as a strength. Embracing multiculturalism allows us to acknowledge and embrace the diversity, ideas, and struggles of all identities (Aragón et al., 2017). Multiculturalism recognizes that treating people equally may not be fair because all people are not the same (Knowles et al., 2009). Instructors can create more welcoming classrooms when they use multiculturalism to respect and value the diverse opinions and life-experiences of their students.



[Interaction Institute for Social Change](#) | Artist: [Angus Maguire](#).

When instructors promote and practice multiculturalism, it can cause underrepresented individuals to perceive less **bias** (Plaut et al., 2009) while also increasing their perseverance, ambition, and success (Walton et al., 2012; Walton & Cohen, 2007). Furthermore,

Faculty who adopt a multicultural ideology use more inclusive and equitable teaching practices than those who subscribe to the colorblindness ideology.

evidence suggests that faculty who adopt a multicultural ideology use more inclusive and equitable teaching practices than those who subscribe to the colorblindness ideology (Aragón et al., 2017). This makes sense because implementing inclusive teaching requires acknowledging differences. Multiculturalism can make underrepresented

individuals feel more valued (Wolsko et al., 2006), but care must be taken to prevent those in the majority from feeling excluded (Plaut et al., 2011). For more information please watch [Colorblind Ideology Is a Form of Racism](#), [The Risks of Color Blindness](#), and [Race in the classroom: Seeing Color](#).

Recognize and Reduce Implicit Bias

The existence of implicit bias means that even well-intentioned people can have unconscious biases which can inadvertently lead to hurtful discriminatory behavior (Cole, 2018; Staats et al., 2017). The majority of White people believe they do not see race, treat everyone equally, and are in fact better-than-average at being racially unbiased, but it is clear from the data that this is far from true (Staats et al., 2017). Similarly, some people of color believe that as the victims of racism it is impossible for them to be biased or racist (Kendi, 2019). The truth is that implicit bias affects us all. The good news is that there are many steps that instructors can take to reduce their implicit biases. One of the first and most important steps is to become more aware of the implicit biases you hold. This is most easily accomplished by taking an Implicit Association Test (IAT, <https://implicit.harvard.edu/implicit/>); some have even suggested that IATs should be a mandatory part of faculty training (Killpack & Melón, 2016). These free online tests are publicly available and allow individuals to examine their own biases in a comfortable and private environment. The IATs are well validated and have been shown to provide an accurate assessment of the test-taker's subconscious associations. It is not uncommon to feel nervous about taking an IAT or about feeling uncomfortable about the results. Once you have examined your own implicit biases you will be better equipped to be aware and mindful of these biases so that you can consciously and intentionally try to interrupt, mitigate, or prevent them.

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Other techniques for reducing or preventing the effects of implicit biases include 1) acknowledging the role implicit bias has in preventing student success (Killpack & Melón, 2016), 2) using evidence-based decision making, 3) considering how implicit bias affects teaching practices and assessments (Killpack & Melón, 2016), 4) seeking positive exemplars and counter stereotypical examples that challenge biases and assumptions (Critcher & Risen, 2014; Lai et al., 2014), 5) being skeptical about decisions made during times of stress or high cognitive load, 6) taking notes about and reflecting on the decision making process, 7) reducing subjectivity and ambiguity by making class materials clear and standardized, 8) rejecting stereotypical associations (Johnson et al., 2018), 9) speaking up if you believe a policy or decision may lead to disparities, 10) engaging in real or imagined intergroup contact (e.g. meaningful work with individuals from diverse backgrounds and life experiences) (Pettigrew, 1997; Turner & Crisp, 2010), 11) considering the moral implications of your behavior and how these behaviors overtly display your intentions and values (van Nunspeet et al., 2015), 12) soliciting feedback from other instructors or students to determine whether your implicit biases are affecting your actions or behavior in the classroom, and 13) performing positive meditation about marginalized groups (Staats et al., 2017). For more information please see the Kirwan Institute's Implicit Bias Training Modules (<http://kirwaninstitute.osu.edu/implicit-bias-training/>).

Asset Mapping

Asset mapping can reduce task assignment bias and intellectual marginalization to create more equitable team dynamics (Stoddard & Pfeifer, 2018). This technique involves determining the strengths and resources of each member of the team as well as areas in which they want to build upon or grow. Tasks can then be assigned by linking them to a specific team member's strengths and skills. In addition to reducing task assignment bias, asset mapping also helps students to build confidence, overcome stereotypes, and get to know each other.

Countering Microaggressions with Microaffirmations

The first step to stopping **microaggressions** is for faculty to be aware of how the language used in the classroom can have large impacts on students (Seidel et al., 2015). In addition to this 'doing no harm' strategy, instructors also have an opportunity to 'do right' by their students by using **microaffirmations**. Microaffirmations occur when the instructor uses positive language to increase inclusion, build relationships, and encourage students (Powell et al., 2013; Rowe, 2008; Seidel et al., 2015). Instructors can give

Instructors can give microaffirmations by listening carefully, being kind, and by subtly modulating the tone of their voice in ways that show genuine respect for students.

microaffirmations by listening carefully, being kind, and by subtly modulating the tone of their voice in ways that show genuine respect for students and concern about their wellbeing (Asai, 2020; Estrada et al., 2019). Microaffirmations can lower stress, increase student persistence, and increase feelings of belonging (Estrada et al., 2019; Harrison & Tanner, 2018).

Even if faculty members avoid microaggressions and say microaffirmations, the question remains about what to do when microaggressions are committed by students. In these cases, faculty can choose to address the microaggression in several ways including a direct confrontation, a class discussion, and/or providing counter-examples (Boysen, 2012). No solution is perfect in every situation, but effective approaches include 1) acknowledging the microaggression to show you are aware of it and understand how it can be potentially harmful, 2) validating the negative feelings felt by students who are the target of the microaggression to show your support and to reduce their cognitive load (Gaztambide, 2012), 3) making it clear to students that microaggressions have no place in the classroom, 4) being available for affected students if they would like to talk more about what happened, and 5) meeting privately with the student(s) who initiated the microaggression so they will not feel isolated or resentful, and so that they can learn more about inclusivity in the classroom (Harrison & Tanner, 2018).

The Value Affirmation Intervention Combats Stereotype Threat

The value affirmation (VA) intervention reduces the achievement gap by nearly as much as converting a class to an active learning format, yet it only requires minimal student and instructor effort and can be accomplished in as little as 30 min of class time (either in person or online) (Jordt et al., 2017). It increases students' feelings of belonging by bolstering their self-worth and integrity. It works by interrupting the recursive feedback loop that occurs when students perform poorly, get subsequently demotivated, and then perform even worse on future assessments (Cohen et al., 2009). Breaking this vicious cycle allows students to succeed (Cohen et al., 2009). The VA intervention involves instructors providing students with a list of 12 values; students then select and write about the 2-3 values that are most important to them, thereby positively reinforcing their values. Because instructors do not read student responses, this technique is quite feasible in classes with large numbers of students.

Although it was originally designed to combat **stereotype threat** (Cohen et al., 2006), the VA intervention has since been shown to reduce the gender gap (Miyake et al., 2010), social class achievement gap (between FG and CG students) (Harackiewicz et al., 2014), and racial achievement gap (Jordt et al., 2017). Cohen found that this intervention was able to reduce the Black/White student achievement gap by 40% and it boosted GPAs for at least two years (Cohen et al., 2006, 2009). When Jordt et al. used this technique, they reported that it boosted all student scores, but it gave a disproportionate boost to AHN students resulting in AHNs scoring an average of 4.2% higher on exams (Jordt et al., 2017). This intervention also significantly improved grades and retention for FG students, and it halved the FG/CG student achievement gap (Harackiewicz et al., 2014). In addition to boosting student performance, this technique also reduces stress (Creswell et al., 2005) and helps students become more resilient (Sherman & Cohen, 2006). FG students who received the VA intervention performed better in that class and subsequent classes, and exhibited an increased likelihood of taking a subsequent biology course when compared to FG students who were in the control group (Harackiewicz 2014).

Although it was originally designed to combat stereotype threat, the VA intervention has since been shown to reduce the gender gap, social class achievement gap (between FG and CG students), and racial achievement gap.

INCREASE STUDENT BELONGING

A strong sense of belongingness is crucial for student motivation, engagement, perseverance, and achievement (Dewbury & Brame, 2019; Freeman et al., 2007; Walton et al., 2012; Zumbunn et al., 2014). Fortunately,

There are many things that instructors can do to help students feel as though they belong in the class and the field as a whole.

there are many things that instructors can do to help students feel as though they belong in the class and the field as a whole. The most prominent methods, which are further discussed below, include increasing student-instructor rapport, using student names, encouraging participation, using a belongingness intervention, showcasing counter-stereotypical scientists, and addressing the imposter phenomenon.

Student-Instructor Rapport and Instructor Immediacy

Establishing a good student-instructor rapport has been shown to increase student feelings of belongingness, reduce their anxiety, and increase positive attitudes towards the instructor (Wilson et al., 2010). There are many simple things instructors can do to increase their rapport with their students so that students see them as warm, approachable, supportive, and willing to listen. Instructors can increase their rapport and warmth by using language that is friendly, understanding, and welcoming (Freeman et al., 2007). For example, instead of saying “I expect all students to attend every class” instructors could say, “Students should attend most class sessions; please let me and

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your team know if extenuating circumstances prevent you from attending on a particular day”. In addition to showing warmth towards students, instructors can increase student belonging by being more open to student thoughts and ideas (Freeman et al., 2007); this could involve listening to student suggestions, soliciting anonymous student feedback, allowing students to vote on different project options, or allowing students to collectively draft rubrics through which they will be assessed. Another simple way to increase instructor-immediacy is to greet students and talk to them before class begins. These informal conversations help

instructors and students get to know each other; sharing personal stories can also help to humanize the professor, help establish a growth mindset, and counter negative preconceptions about the instructor or class (Hsu & Goldsmith, 2021).

Using Student Names

Perhaps the most important word that a person can hear is their own name. Using students' names has been shown to increase student belonging (Reinholz et al., 2020). Memorizing student names can sometimes be a daunting challenge (especially for large courses), but it is made easier by using photo rosters, student introduction videos, or name tents. Using video or sound recording options are especially helpful for pronouncing names properly, which is crucial as mispronouncing names can increase student anxiety (Kohli & Solórzano, 2012). Student names are even easier to use in an online setting where names are listed under each students' video-feed. Using student names has been shown to increase positive student attitudes, behaviors, and their perceptions about the course (Cooper et al., 2017); it also helps improve student-instructor communication and relationships (Cooper et al., 2017). Lastly, name usage helps students to feel valued and invested in the course and increases the likelihood that they will ask for help (Dewbury & Brame, 2019).

Encouraging Participation

Encouraging student participation in the class is strongly correlated with student belonging (Freeman et al., 2007). Instructors should acknowledge that contributing can be hard and emphasize that they nonetheless really appreciate hearing questions, ideas, and answers from all students (Reinholz et al., 2020). Provide time for students to write and think before asking them questions (Tanner, 2013); this especially helps students who take longer to think, are introverted, or who are non-native speakers. Thanking students for their answers can make it clear that their contributions were valued regardless of whether they were right or wrong.

Group Projects Encourage Cooperation

Instructors can increase students' sense of belonging by having them work in groups (Elliott et al., 2016). Group work allows students to get to know each other, helps them to learn from their peers, and helps encourage all students to participate. Group projects also promote cooperation and teamwork, while discouraging competition (Elliott et al., 2016).

Belongingness Intervention

Belongingness interventions have shown great promise in helping students feel more connected with the classroom. Walton and Cohen created a short (~1 hour) belongingness intervention where they explained that students commonly question whether they truly belong in college, but that these worries are normal, short-lived, and dissipate over time. Students in the intervention also wrote an essay for next year's incoming students about how their own feelings of belonging changed over time. This intervention disproportionately increased the grades of Black students from their sophomore through senior years and halved the Black/White student achievement gap (Walton & Cohen, 2007, 2011); it also improved self-reported physical health, happiness, and

The intervention works by cutting the negative relationship between experiences of adversity and feelings of belonging.

sense of belonging of Black students. The intervention works by cutting the negative relationship between experiences of adversity and feelings of belonging such that Black students no longer construe difficulties as being diagnostic of their belonging (Walton & Cohen, 2011). Another belonging intervention which also sought to normalize social adversity was found to

decrease the attrition gap and the GPA gap for less advantaged students, while simultaneously increasing social and academic integration on campus during their first year of college (Yeager, Walton, et al., 2016).

Scientist Spotlight Intervention

Encouraging students to visualize themselves doing research can increase feelings of belonging, especially for AHN student belonging (Dewbury & Brame, 2019). Additionally incorporating homework related to counter-stereotypical examples of scientists can help to signal an inclusive and identity-safe environment. The scientist spotlight intervention is an activity that presents counter-stereotypical examples of scientists engaged in research related to course topics (Schinske et al., 2016). This activity asks students to review resources about scientists' research (i.e., journal article or popular science article) and personal history (i.e., an interview, podcast, website, TED Talk etc.) and then write a 350-word reflection about what they found

The scientist spotlight intervention is an activity that presents counter-stereotypical examples of scientists engaged in research related to course topics.

most interesting, what they learned, what questions they have, and what their research says about the types of people who do science. Essays are not graded and only take about 5-10 minutes to complete. Students completed ten scientist-spotlight assignments over the course of the semester. Doing this activity helped to decrease scientist stereotypes and increase students relating to scientists for at least six months after the class

ended. This intervention also showed small but significant increases in students' interest in science and student grades. In a similar intervention, Yonas et al. assigned students to listen to and reflect on nine podcasts featuring scientists discussing a “true, personal story about science” (Yonas et al., 2020). Students found these podcasts to be valuable, engaging, and relatable, and they felt that the podcasts changed their perceptions about scientists.

Address the Imposter Phenomenon

Addressing the imposter phenomenon is challenging, but a number of suggestions have been proposed in the scientific and popular literature. One option is to validate the person's doubts and fears and suggest they consider group therapy (Matthews & Clance, 1985). Alternatively, those with imposter syndrome may be able to alter or reframe thought processes that make them feel like a fraud (Abrams, 2018). People suffering from imposter syndrome may also benefit from treating any comorbid afflictions (e.g., anxiety or depression) and visiting a psychologist (Bravata et al., 2020). In any case, treating any form of mental illness is beyond the scope of a university instructor's duties; consequently, it is recommended that instructors refer any student experiencing imposter syndrome to campus resources including counselors or mental health advocates. Instructors can also help by increasing awareness about imposter syndrome and by sharing mental health resources in their classrooms (Le, 2019).

REDUCE STRESS AND ANXIETY

General Strategies to Reduce Stress and Anxiety

Although they should not take on the role of trained mental health professionals, instructors' frequent contact with students renders them 'first-line responders' in the battle against **stress** and **anxiety** (Di Placito-De Rango, 2018). Instructors should familiarize themselves with common mental health challenges, offer support and understanding, and direct students to the appropriate resources as needed (Di Placito-De Rango, 2018). By doing this they will have more insight about how to approach mental health conversations when they arise and they will have a list of campus contacts that can help connect students to counselors, tutors, disability services, or other resources when they need them; in severe cases where the student indicates that they may harm themselves or others, the instructor is advised to directly walk the student to someone who is better equipped to help them (e.g. counseling, health, or law enforcement services). Directing students to the appropriate resources is particularly important because students frequently do not have a good understanding of what services are available (Dobmeier et al., 2013; Zivin et al., 2009), and are often hesitant to use these services due to social stigma and other concerns (Eisenberg et al., 2009; Wu et al., 2017).

Instructors should familiarize themselves with common mental health challenges, offer support and understanding, and direct students to the appropriate resources as needed.

There are several steps instructors can take to decrease or eliminate student anxiety. First, instructors should explain their rationale for why they are using active learning in the classroom. Students may be less anxious and more open to active learning techniques if they have a better understanding of why they are being used. Second, instructors should promote the idea that participation is highly valued and that it is 'okay to be wrong' (Downing et al., 2020). When students are brave enough to contribute, you should thank them for their answers. Use positive error framing to view wrong answers as learning opportunities; instead of judging, chastising, or immediately correcting a student, the instructor can begin by saying something like 'I used to think the same thing' or 'I am really glad you brought this up because it is a very common misconception'.

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Positive-error-framing like this can reduce stress, improve metacognition, and boost learning (Downing et al., 2020; Steele-Johnson & Kalinoski, 2014). Third, instructors can reduce stress and anxiety for poor performing students by outlining appropriate coping strategies such as support seeking, problem solving, studying techniques, metacognition, and cognitive restructuring (Henry et al., 2019). These strategies can be used preemptively to prevent stress and anxiety or can be used to reduce stress and anxiety that has

already occurred. Fourth, having students do a self-affirmation activity such as writing about what they value reminds them of positive aspects of themselves so that they are less threatened and less stressed by negative events (Yeager & Walton, 2011). Fifth, instructors should give students ample time to think before calling on them to present an answer (Cooper, Downing, et al., 2018). This additional time can reduce anxiety related to time-pressure. Sixth, cold calling (i.e., publicly soliciting answers from students who did not volunteer) should be avoided as it has been shown to increase anxiety (Cooper, Downing, et al., 2018) and the risk of stereotype threat (Waugh & Andrews, 2020), and even reduce learning in students with high anxiety (Cohen et al., 2019). Instead of cold calling, instructors can lower anxiety by using requests for volunteers, clicker questions, or 'warm calling' (Downing et al., 2020). Warm calling involves asking students to work on answers as a group and then report their group's answer in order to take the pressure off the individual student. Lastly, because students naturally feel a lot of anxiety about answering verbal or written questions, instructors should frame social adversity as shared and short-lived as a way to increase student resilience (Walton & Cohen, 2011). This helps students to realize that everyone (including the instructor and high performing students) has challenges and makes mistakes from time to time. Instructors can also mention that a little anxiety can be beneficial as it can help students to pay attention and stay motivated (Downing et al., 2020). Reducing stress and anxiety in active learning classrooms using the above approaches can create a more comfortable classroom environment, increase trust in the instructor, and increase student performance (Hsu & Goldsmith, 2021).

Reducing Exam-Related Stress and Anxiety

Among all of the stressors that students face, high stakes examinations are certainly near the top of the list. High stakes exams have been shown to cause anxiety in diverse settings (Cizek & Burg, 2006; Kruger et al., 2007), and test anxiety contributes to student perceptions about exam difficulty and lowers their academic performance (England et al., 2019). Evidence suggests that underrepresented students and women may experience more test anxiety (Ballen et al., 2017). Furthermore, student anticipation of stereotype-laden exams may cause additional student worries (Logel et al., 2009).

Instructors can adopt a number of different strategies to help reduce or prevent test anxiety including: 1) explicitly stating that performing poorly on a single exam does not say anything about the student's intelligence (J. Croizet & Claire, 1998; J. C. Croizet et al., 2004), 2) reducing or eliminating high stakes exams and giving more weight to smaller-stakes quizzes and other formative assessments (Bailey et al., 2017; Putwain, 2008), 3) having a policy of dropping the lowest quiz or exam score, 4) adopting a grading scheme that focuses more on mastery and rewards students for improving over time (Bailey et al., 2017), 5) using open-book exams or allowing 'cheat sheets' on exams (Durning et al., 2016; Erbe, 2007), 6) eliminating any triggering or stereotype-laden language from exams, 7) having students write about their testing worries just before an exam to counter anxiety and improve exam performance (Park et al., 2014; Ramirez & Beilock, 2011), and 8) talking about stereotype threat before an exam. Preemptively talking about stereotype threat reduces its effects, lowers anxiety, and improves exam performance (Johns et al., 2005). Replacing high stakes exams with more formative assessments lowers the impact and anxiety of each assessment, provides instructors and students with more feedback over time, and it has also been shown to reduce the achievement gap for female biology students (Ballen et al., 2017). As mentioned in the preceding section, instructors can also foster a classroom culture whereby some stress can be perceived as being beneficial in that it can help students stay motivated and focused; doing this not only decreases anxiety, but also improves exam performance (Jamieson et al., 2013). Collectively the above strategies and approaches can increase the performance of both low and high performing students (Harris et al., 2019; Hsu & Goldsmith, 2021).

Have students write about their testing worries just before an exam to counter anxiety and improve exam performance.

Noncontent Instructor Talk and Instructor Immediacy Can Decrease Anxiety

While classroom discourse is typically dominated by course content, noncontent instructor talk also has an important role to play, especially when it comes to reducing anxiety (Creasey et al., 2009; Seidel et al., 2015)

Using noncontent instructor talk to decrease anxiety starts with increasing instructor immediacy to make the professor more relatable, more approachable, and less intimidating.

and combating stereotype threat (Seidel et al., 2015).

Using noncontent instructor talk to decrease anxiety starts with increasing instructor immediacy to make the professor more relatable, more approachable, and less intimidating (LeFebvre & Allen, 2014; Seidel et al., 2015). As instructor immediacy increases, a corresponding decrease is seen in student anxiety (Hsu & Goldsmith, 2021; Kelly et al., 2015). One simple

approach to let your students express themselves is to begin the semester with a “Getting to Know You” survey which asks them “Is there anything else you’d like the instructor to know about you?” and “Is there anything else the instructor can do to help you succeed in this course?”. Not only does this help instructors to get to know their students, but it also gives students space to reveal aspects of their identity or challenges they may be facing if they wish to share. Anxiety and stereotype threat can also be reduced when the instructor states that they recognize how some local or national news items (e.g., the murder of George Floyd) can affect the student stress, anxiety, and well-being. When these situations arise, the instructor should validate students’ feelings and let them know that they intend to be more flexible about deadlines and will hold more office hours.

Using Humor in the Classroom

Using appropriate humor in the classroom has also been shown to reduce anxiety, establish a positive classroom environment, strengthen student-instructor relationships, and increase instructor immediacy (Bekelja Wanzer et al., 2006; Cooper et al., 2020; Cooper, Hendrix, et al., 2018). Not everyone can make the students roll on the floor with laughter (which is usually not all that desirable anyways), but students will at least recognize the attempt and appreciate the effort. Humor is not something that comes naturally to everyone, and instructors should not do anything that they are uncomfortable with; that said, a little humor can help liven up the classroom and increase students’ learning, engagement, and motivation (Banas et al., 2011; Neumann et al., 2009). Incorporating a little humor on exams or other assessments can decrease stress and anxiety while increasing their perceptions of exam performance (Berk, 1996, 2000). While humor can be a powerful and positive force in the classroom it should not be used at the expense of course content, and it should never marginalize or disparage anyone (Bekelja Wanzer et al., 2006; Cooper et al., 2020; Cooper, Hendrix, et al., 2018).

A little humor can help liven up the classroom and increase students’ learning, engagement, and motivation.

IMPROVE ENGAGEMENT AND PERFORMANCE

Use Active Learning

Active learning is a process through which students actively engage-with and reflect-upon course content. It has been shown to increase learning (Deslauriers et al., 2019; S. Freeman et al., 2014), improve attitudes and perceptions about science (Hsu & Goldsmith, 2021), and reduce the achievement gap for underrepresented minorities (S. Freeman et al., 2014) and women (Lorenzo et al., 2006). Active learning was shown to reduce the achievement gaps between minoritized groups in STEM (MGS, includes both AHN and low-GWI students) and non-MGS students; high-intensity active learning reduced gaps in exam scores and passing rates by 33% and 45% respectively (Theobald et al., 2020). These AHN performance gains are driven by increased student self-efficacy (Ballen et al., 2017). Active learning is particularly effective when students perceive that it is improving their learning (Downing et al., 2020).

In addition to lowering the achievement gap, active learning can increase or decrease student anxiety (Downing et al., 2020). Active learning can decrease anxiety because it provides students with additional help from peers and instructors, and it provides different learning modalities. Active learning can also increase anxiety by intensifying student fears about negative evaluation, especially on topics they are struggling with. This occurs because the fear of looking stupid in front of peers increases students' mental load and thus decreases their performance. Instructors can reduce anxiety associated with active learning by keeping students in consistent groups where they know their peers, and by reducing cold-calling.

Active learning can increase or decrease student anxiety.

Most active learning exercises involve calling on individual students or groups to voice their answers or ideas. When calling on students, instructors should attempt to hear from a diverse array of voices, including those from different racial or ethnic backgrounds and from different genders. One strategy is to wait to see at least five raised hands before calling on a student (Reinholz et al., 2020). When students readily participate instructors should reward their efforts by showing appreciation and enthusiasm. By encouraging class participation and discourse, instructors can increase students' understanding of the course content (Chi et al., 1994; Trujillo et al., 2016), their sense of identity (Boaler & Greeno, 2000) and belonging within the discipline (Le, 2019; Lewis et al., 2016).

Faculty who are new to active learning should recognize that they may not see big changes in student

outcomes right away. Instead, they should gradually redesign their courses to include more evidence-based active learning strategies which are tailored to both their courses and their students. Instructors should monitor student progress and keep making incremental changes and improvements until the achievement gaps are eliminated (Theobald et al., 2020).

Interest and Motivation

Instructors can increase interest and motivation among their underrepresented students in several ways. First and foremost, instructors should reduce or eliminate factors that have been shown to decrease student motivation such as **fixed-mindset** beliefs and **stereotype threat**. In addition to avoiding motivation decreases, instructors can disproportionately motivate underrepresented groups by paying attention to what interests them. Instructors can increase interest for all students by showing how the coursework relates to real-life (Dewbury & Brame, 2019); this is particularly beneficial to AHNs and low-performing students who are often very practically minded and value material they feel will be useful to them later (e.g., utility value) (Harackiewicz & Hulleman, 2010; Sanchez, 2000).

The utility value of a task positively correlates with interest among historically disadvantaged or underrepresented groups.

The **utility value** of a task positively correlates with interest among historically disadvantaged or underrepresented groups (Harackiewicz & Hulleman, 2010). Because AHNs are highly invested in helping their communities, their interest in scientific research careers can be increased when instructors highlight the

altruistic value of research (Thoman et al., 2015). Instructors can also increase student motivation by being sensitive to the preferred learning styles of different cultural groups (Sanchez, 2000). For example, both Hispanic and Native American students prefer assignments that are collaborative instead of competitive and concrete instead of abstract (Sanchez, 2000). Both groups also value group assignments that allow them to safely express and reflect on ideas, and which provide them with feedback from both peers and instructors (Sanchez, 2000).

The utility value intervention is a social-psychological intervention that increases student interest, engagement, and motivation by showing why the course content is valuable and relevant (Harackiewicz et al., 2016). While this intervention improved grades for all students, it was particularly effective for FG-AHN students as it lowered the achievement gap between FG-AHN students and CG-majority students by 61% when compared to students in the control condition (Harackiewicz et al., 2016). This intervention disproportionately benefited FG-AHN, but not FG-majority students, highlighting the importance of considering intersectionality in the classroom.

Teach and Encourage Good Studying Techniques

Studying techniques are learned skills and can therefore not be assumed to be present in students. Historically disadvantaged groups of students often lack sufficient time-management and studying skills (Engle et al., 2006; Rodriguez et al., 2018). Students from low-GWI backgrounds also spend significantly less time studying than their wealthier peers (Martin, 2015; Walpole, 2003).

High-performing students commonly use good planning and time-management skills (Sebesta & Bray Speth, 2017) which reduce procrastination and improve educational outcomes (Hsu & Goldsmith, 2021; Koch & Kleinmann, 2002). Instructors should accept responsibility for teaching students how to study so that they can approach studying with an open mind and a growth mindset (Tomanek & Montplaisir, 2004). When instructors facilitate the development of study skills it can lower student stress and anxiety, and increase their performance (Hsu & Goldsmith, 2021).

Studying techniques are learned skills and can therefore not be assumed to be present in students.

Students can improve their studying performance by considering the ‘who’, ‘what’, ‘where’, and ‘when’ of studying. When considering the ‘who’ of studying, students should ask ‘who’ they can go to for help. This most commonly includes peers, TAs, and instructors. Although asking for TA or instructor assistance is among the least common study habits, it is frequently used by high-performing students, and has been shown to significantly improve exam grades (Sebesta & Bray Speth, 2017). Instructors can also clarify the ‘what’ of studying by reminding students about what resources are available and how they should be prioritized. Commonly studied material includes the textbook and any associated practice problems, practice exams, old quizzes, PowerPoint slides, notes, and online resources (i.e., course website, Khan Academy, YouTube videos etc.). Instructors should emphasize the course learning objectives and provide examples of assessment questions based on these objectives (Osueke et al., 2018). Students should carefully select ‘where’ they do their studying and should select a quiet, comfortable, distraction-free location (Sebesta & Bray Speth, 2017); distraction-free spaces are critical as studies have reported that students are distracted during about 20% of their study time and these distractions negatively correlate with exam performance (Walck-Shannon et al., 2021). Varying the environment by studying in different places has also been shown to enhance recall of information during exams (Bjork & Bjork, 2011). Once they have selected appropriate study locations, students can plan ‘when’ they will study. Ideally students should space out their studying (i.e., spacing) by studying early and often. Spacing is superior to cramming as it results in better exam scores and improved long-term retention (Bjork & Bjork, 2011). AHNs often underutilize spacing, but a simple study skills intervention can increase their use of spacing and reduce the AHN/White achievement gap (Rodriguez et al., 2018).

In addition to thinking about the ‘who’, ‘what’, ‘where,’ and ‘when’ of studying, students should be thoughtful about ‘how’ they are studying. Effortful study strategies in which students create something or test themselves are more effective at promoting long-term learning than passive strategies (Walck-Shannon et al.,

2021). Students who studied using active strategies perform ~5-10% better on exams than students who only studied passively, and student exam performance improves by ~3-5% for each effortful study strategy that is

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used (Walck-Shannon et al., 2021). Effortful studying strategies include self-testing (i.e., completing problem sets, practice exams etc.), summarizing textbook sections and notes (Sebesta & Bray Speth, 2017; Walck-Shannon et al., 2021), creating concept maps, participating in study groups, explaining concepts to a classmate, and answering questions posed by other students (Bjork & Bjork, 2011). Encouraging self-testing is key as students often feel that they learn more from superficial strategies such as rereading the textbook (Walck-Shannon et al., 2021). Self-testing

has also been shown to be underutilized by AHNs, but it can be increased by using a simple study skills intervention (Rodriguez et al., 2018). Another way to encourage effortful study strategies is to have students turn in a product (i.e., quiz answers, note summaries, concept explanations etc.) of their studying as a low-stakes assignment (Walck-Shannon et al., 2021).

Regardless of what effortful strategies are used, students can further improve their retention and exam performance by focusing rather than multitasking. While college students often believe that multitasking increases their productivity, it actually impairs their learning (May & Elder, 2018). Instructors can reduce multitasking by limiting the use of mobile phones and other electronic devices in their classrooms with clear policies on their syllabus.

While students should not multitask, they can improve their long-term retention by studying multiple topics together in a process called interleaving (Bjork & Bjork, 2011). Interleaving increases the frequency of recalling and making comparisons between topics, which ultimately results in higher order thinking (Bjork & Bjork, 2011). Instead of interleaving, most students study a single topic at a time (i.e., blocking) because it deceptively feels more effective. That said, extra care should be taken as “learners—as well as instructors—are at risk of being fooled by this pattern” (Bjork & Bjork, 2011).

Another important aspect of the ‘how’ of studying is for students to use metacognition to ask, “how am I doing?”. Students can use **metacognition** to recognize and resolve their own knowledge gaps. Whatever study strategies they choose, students should periodically evaluate the effectiveness of those strategies. If their current strategies are not working, students should determine if they are doing those strategies correctly (or for long enough) and they should consider adopting alternative study strategies to improve on future assessments.

Instructors can further encourage good studying practices in several ways. First, they can allow students the opportunity to review and retake past quizzes and exams after thinking metacognitively about their performance (Walck-Shannon et al., 2019). This practice encourages content mastery and can help students recognize gaps in their own studying practices. Second, instructors can use scaffolding to help students create

goals and monitor their progress via self-regulated learning (Sebesta & Bray Speth, 2017). Third, instructors can help students to prepare for exams by offering formative assessment (e.g., quizzes, assignments) that accurately reflect the difficulty and type of problems they may encounter on the exam (Tomanek & Montplaisir, 2004). Fourth, instructors can encourage students to attend office hours and review sessions. Fifth, instructors can offer timely feedback that keeps students well apprised of their current standing in the course. Intrusive advising is one approach that provides low-performing students with email alerts about their performance and resources to help them improve (Dodge et al., 2015). Lastly, as mentioned above, instructors should encourage students to practice spacing, focusing, interleaving, and effortful studying rather than cramming, multi-tasking, blocking, and passive strategies (Walck-Shannon et al., 2021).

Goal Setting Intervention

Consciously setting goals has been shown to increase student self-regulation (Zimmerman & Schunk, 2001), self-discipline, and performance (Duckworth et al., 2013), while also reducing procrastination (Kruglanski, 2002), and uncertainty-related anxiety (Hirsh et al., 2013). An intervention by Schippers et al. aimed to enhance goal-setting behavior in first-year college students (Schippers et al., 2015). In this simple intervention, students created a vision about what their life would look like in 3-5 years, and then created eight clear and realistic goals with detailed strategies for how these goals could be obtained. This intervention increased academic achievement and retention of all students, but was especially helpful for ethnic minorities (Schippers, 2015). It decreased the ethnic performance gap by 38% and 93% in the first and second years respectively. These results were likely caused in part by the fact that this intervention improved students' self-regulation and thus enhanced their exam-taking behavior.

Increasing Organization

Increasing organization improves student performance and makes the course more welcoming for students. The course syllabus, schedule, rubrics, and deadlines should be clear and easy to find. Having more graded assignments, scaffolded projects, and in-class active learning activities increases course structure and improves student performance (Freeman et al., 2011). When graded preparatory homework, guided-reading questions, and in-class extra credit activities were implemented in an introductory biology course, it increased studying and exam performance for all students by 3-4% while having an additional benefit for African American students (3%) and FG students (2.5%) (Eddy & Hogan, 2014). Increased course organization and structure also improved Black student in-class participation, and their perceptions of the importance and value of homework (Eddy & Hogan, 2014).

Encourage a Growth Mindset

Research shows that instructors can adopt several pro-growth-mindset behaviors to help their students. Instructors can encourage a growth mindset in their students by defining and explaining the different mindset types, praising students for improvement, encouraging struggling students to come to office hours, and by promoting metacognition and self-reflection (Canning et al., 2019; Hsu & Goldsmith, 2021; Powers, 2015). Additionally, instructors can consider adopting a mastery approach that gives students a second chance to answer exam questions they got wrong (Fernandez, 2020). Both growth mindset and self-efficacy can also be improved using formative assessments that let students recognize and correct their misconceptions as they are learning (Yin et al., 2008).

In addition to the instructor behaviors listed above, **growth mindset** interventions can also be used to change student beliefs and attitudes in ways that improve their course performance and lower their stress and anxiety (Hsu & Goldsmith, 2021). Well-crafted interventions attempt to convince students that problem solving, reasoning, class performance, or another ability can be improved; oftentimes this involves a helpful analogy such as “your brain is like a muscle—it gets stronger (and smarter) when you exercise it” (Yeager & Dweck, 2020). Growth mindset interventions often include a writing component where students relate the concept of a growth mindset to their own lives or use it to give advice to future students who may be struggling academically. To be effective, such interventions must encourage students to actively improve by changing their strategies, asking for help, doing challenging work, or adopting new learning strategies (Yeager, Romero, et al., 2016; Yeager & Dweck, 2012). When students believe that they can become smarter they typically work harder and use more effective learning strategies.

A 2016 study by Yeager et al. was among the first to perform a large-scale growth mindset intervention in a university setting. This study found a 40% reduction in the full-time enrollment gap between advantaged and disadvantaged (i.e., racial minority and first-generation students) students. In a similar intervention involving 7,686 college students significantly improved GPAs for Latinx students and it reduced the White/Latinx academic achievement gap by 72% (Broda et al., 2018). In another intervention, the treatment group read an article entitled “You Can Grow Your Brain” and was then tasked with writing two short reflections shortly before taking two subsequent exams. In their reflections, students wrote about how this article influenced their preparations and study strategies. This intervention increased the final exam scores of AHNs by more than 5% and eliminated the racial achievement gap but had no effect on the performance of White students (Fink et al., 2018). A 2018 meta-analysis examining many such growth mindset interventions found that they are especially beneficial for low-GWI and high-risk students (Sisk et al., 2018).

ADDITIONAL STRATEGIES FOR FG AND TRANSFER STUDENTS

Helping First-Generation Students

FG students have difficulties with entering college and remaining enrolled, largely because they are less academically and socially prepared than their peers (Engle et al., 2006). To maximize their chances for success, FG students should be made aware of the resources that are available to them. Before entering college, it is recommended that FG students participate in workshops about financial aid and navigating the college admissions process so that they can be well informed about the logistical, bureaucratic, and financial aspects of attending college (Engle et al., 2006). Additionally, taking summer bridge programs between high school and college can help FG students to fill knowledge gaps and prepare for the academic rigor of college courses (Engle et al., 2006). Once entering college, FG students can continue to build their knowledge base by taking advantage of supplemental courses, tutoring, directed workshops, and learning communities, and by consulting their advisors, counselors, peers, mentors, and instructors (Engle et al., 2006; Martinez et al., 2009).

Instructors are well positioned to help FG students in a variety of ways. For starters, instructors can share advice about studying, writing, test-taking, and time-management; they can also explain how they overcame their own academic challenges. When instructors help FG students to increase their studying and writing skills, these students can improve their critical thinking, writing ability, and willingness to engage in cognitively challenging tasks (Pascarella et al., 2004). Furthermore, instructors can point students towards the appropriate campus resources (e.g., writing centers, libraries, computer labs, student services, academic success centers, counseling services, conflict resolution centers, stress management etc.) as well as relevant scholarships, job openings, and professional development opportunities. During office hour visits instructors can answer student questions, provide students with detailed feedback about their performance, and attempt to identify and solve any barriers they are facing (Goldman et al., 2022; Shelton, 2011); instructors should maintain high academic standards while also being sensitive to FG student needs to prevent them from becoming discouraged. This could involve increased flexibility surrounding deadlines to help accommodate their work or childcare needs. Because FG students often focus on pragmatic and practical concerns (e.g.,

When instructors help FG students to increase their studying and writing skills, these students can improve their critical thinking, writing ability, and willingness to engage in cognitively challenging tasks.

helping their family or getting a job), instructors should highlight the real-world value of course topics (Goldman et al., 2022; Harackiewicz et al., 2016). Instructors can also have students think metacognitively about their progress towards their educational goals and what barriers are standing in their way. By providing periodic reminders for students to check their grades, and by issuing alerts for underperforming students, instructors can help FG students become more aware of their status in the course and whether or not they are falling behind.

Instructors can also encourage participation in extracurricular activities, as FG students have been shown to gain disproportionate benefits from increased participation in extracurricular activities when compared to their **CG** classmates (Pascarella et al., 2004). Doing extra-curricular or co-curricular activities helps FG students to take responsibility for their own learning, formulate their degree plans, and improve their openness to diversity. Despite these benefits, FG students normally shy away from extracurricular activities so they may require additional encouragement. Benefits from extracurricular activity participation likely occur because these activities expose FG students to informed peers who know how to select courses, study effectively, and navigate the college environment. These peer-to-peer interactions help FG students adapt to the expectations and norms of college life so that they can adopt the strategies and behaviors that are necessary for success (Engle et al., 2006). Another way that instructors can help FG students to interact with their peers is to facilitate the formation of study groups in class, which can help to open a door for FG students who have nowhere else to go.

In addition to sharing their expertise, providing resources, and encouraging extracurricular activities, instructors can assist FG students with their psychosocial development by increasing their **self-efficacy** and their capacity to cope with stressful situations. For example, instructors can increase FG students' self-efficacy by believing in them and helping them to succeed. Studies show that self-efficacy and self-determination are important for FG student graduation and success (Shelton, 2011); in essence these students must 'know' that it is their choice to graduate and that they will complete their degree requirements. Self-efficacy beliefs have been shown to predict higher GPAs, especially for FG students (Majer, 2009). Another way that FG students can improve their academic performance is by learning how to use coping strategies to manage the multiple stressors they face (Phinney & Haas, 2003). Stress-busting strategies include: 1) being proactive to prevent and manage stress ahead of time, 2) getting emotional support from friends and family, 3) seeking academic support from teachers, students, and tutors, 4) reframing problems in a positive way, and 5) accepting some problems as something they must learn to live with (Martinez et al., 2009).

The difference-education intervention helps FG students see their background and differences as strengths instead of sources of anxiety (Stephens et al., 2014). In this intervention, FG students learn about successful senior students who had life experiences like their own. The FG participants learn that it is possible for students like them to be successful and that their background could be a source of strength. This intervention was shown to reduce anxiety and improve the GPA of FG students.

Helping Transfer Students

University instructors can use a variety of strategies to help transfer students improve their performance. Many of these strategies are similar to the ones that benefit FG students such as having students work with and get support from their peers (Thomas et al., 2021), and increasing participation in campus activities (Thomas et

Transfer student behaviors such as participating in class discussions, asking questions during class, working hard, and tutoring other students are positively correlated with GPA.

al., 2021). Administrators may also be able to help by notifying instructors of transfer students in their courses so that faculty members can engage with those students, provide feedback and updates, and celebrate their success (Fauria & Fuller, 2015). Transfer student behaviors such as participating in class discussions, asking questions during class, working hard, and tutoring other students are positively correlated with GPA (Fauria & Fuller, 2015). In addition to

encouraging these behaviors, instructors can also improve transfer student outcomes by providing them with prompt oral or written feedback about their academic performance (Fauria & Fuller, 2015).

University instructors should understand that transfer students may feel overwhelmed and may get ‘information overload’ while learning to adapt to a new learning environment. Instructors should communicate key information in a clear and straightforward manner; instructions, tutorials, syllabi, and other information should also be easy to find on the course website (Chin-Newman & Shaw, 2013). Reducing unnecessary emails and highlighting priority ones is also recommended (Foster et al., 2020). Transfer students should be encouraged to take advantage of instructor office hours and review sessions. Furthermore, instructors can assist transfer students by pointing them to institutional resources such as student services or the academic libraries as appropriate. Lastly, instructors can make it clear that they are more than happy to meet with students about navigating the course website or understanding the ‘nuts and bolts’ of the course. In summary, transfer student feelings of belonging and odds of retention can be increased by providing them with appropriate support (Deil-Amen, 2011; Robbins et al., 2004), making these students aware of their own strengths (Soria et al., 2017), and by having them participate in learning communities which help them to carefully consider their academic choices and actively participate in their classes (Thomas et al., 2021).

One intervention by Wilson and Linville that may be beneficial for transfer students deals with the transitional difficulties that students experience when they enter a new school (T. D. Wilson & Linville, 1982, 1985). This intervention teaches students that transitioning to a new school is often accompanied by declines in academic performance and that these declines are normal, short lived, and do not reflect a lack of ability. This intervention caused increased GPAs and made transitioning students 80% less likely to drop out of college.

SUMMARY AND DISCUSSION

AHN, FG, and Transfer Students Face Many Challenges

Achievement gaps exist between **White** and **AHN** students, **FG** and **CG** students, and **transfer** and **non-transfer** students. The ultimate causes of these gaps are numerous, varied, and interrelated, but the primary proximal drivers of the achievement gaps are 1) lack of belongingness, 2) increased stress and anxiety, and 3) decreased engagement and performance. Instructors who wish to ensure the success of all students in their classrooms must acknowledge and address these proximal drivers of the achievement gaps.

Instructor Practices Can Reduce the Primary Drivers of the Achievement Gaps

College instructors have many evidence-based practices in their toolkit that they can use to decrease the achievement gaps in their classrooms. First, because **bias** and **racism** can directly or indirectly affect all three of the proximal drivers of the achievement gap, countering bias and racism is a necessary first step to ensure equity and inclusivity in the classroom. Instructors can combat the barriers created by bias and racism by promoting **multiculturalism**, preventing and responding to microaggressions, using microaffirmations, and by recognizing and reducing their own **implicit biases**.

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Once steps have been taken to counter bias and racism in the classroom, instructors can then turn their attention to addressing the three primary proximal drivers of the achievement gap: 1) lack of **belonging**, 2) increased **stress** and **anxiety**, and 3) decreased engagement and performance. There are many approaches that instructors can use to increase student belonging in their classrooms and a central pillar of these approaches is respect for students and concern for their wellbeing. Students feel that they belong in

the classroom when instructors create a welcoming environment, treat students with respect, increase **instructor immediacy** and instructor-student rapport, increase student autonomy, and encourage student

participation. It is difficult for students who are stressed or anxious to perform at their best. For this reason, instructors should work to reduce student **stress** and **anxiety** by preemptively discussing stress and anxiety coping strategies, using warm calling instead of cold calling, increasing deadline flexibility, reducing the number of high stakes exams, and by using humor in the classroom. In addition, both lack of belongingness and stress and anxiety can be reduced by framing adversity as common and temporary. Lastly, in order to achieve the ultimate goal of reducing or eliminating the achievement gaps, instructors must work to increase student engagement and performance. All of the above approaches including countering bias and racism, increasing student belonging, and reducing stress and anxiety ultimately have the effect of improving student engagement and performance.

Both lack of belongingness, and stress and anxiety can be reduced by framing adversity as common and temporary.

That said, there are several additional things instructors can do to help their students succeed including using active learning, improving organization and structure, encouraging students to adopt a growth mindset, using real-world examples to increase interest and motivation, and by teaching effective studying techniques.

Psychosocial Interventions Can Help Reduce the Achievement Gaps

Some of the most effective strategies for countering the achievement gaps involve the use of **psychosocial interventions**. These psychosocial interventions all require students to engage in some sort of activity either inside or outside of class. These activities are typically short (~15 min to 1 hr) and only need to be done once to get long term benefits. One key aspect of psychosocial interventions is that students should not be told their true purpose if they are to be used most effectively. The effects of psychosocial interventions can be both powerful and long-lasting because they interrupt negative recursive behaviors; for example, a student who feels they do not belong is not likely to perform as well, and the poor scores they receive on assessments are likely to confirm their fears that they do not belong. This review discussed nine types of psychosocial interventions that instructors can use to combat achievement gaps; these interventions are summarized in Table 1.

Table 1. Psychosocial Interventions That Reduce the Achievement Gap.

Intervention	Description	Effects	Reference(s)
<i>Value Affirmation Intervention</i>	Students select and write about 2-3 values from a list that are important to them.	↑ belongingness ↓ stereotype threat ↓ stress ↓ achievement gap	(Harackiewicz et al., 2014; Jordt et al., 2017; Yeager & Walton, 2011)
<i>Belongingness Intervention</i>	Current students write an essay to incoming students about how belongingness concerns are normal and short-lived.	↑ belongingness ↑ social integration ↑ health & mood ↑ grades ↓ achievement gap	(Walton & Cohen, 2007, 2011; Yeager, Walton, et al., 2016)
<i>Scientist Spotlight Intervention</i>	Students complete reflection assignments about counter-stereotypical scientists.	↑ belongingness ↑ science interest ↑ grades ↓ stereotypes	(Schinske et al., 2016)
<i>Study Skills Intervention</i>	Students are given a 10-minute lecture about good study practices and receive weekly reminders.	↑ self-testing ↑ spacing ↓ achievement gap	(Rodriguez et al., 2018)
<i>Utility-value intervention</i>	Shows why the course content is valuable and relevant to the student.	↑ interest ↑ motivation ↓ achievement gap	(Harackiewicz et al., 2016)
<i>Goal Setting Intervention</i>	Students create goals related to their learning, habits, or career aspirations and detail how to obtain those goals.	↑ retention ↑ self-regulation ↓ achievement gap	(Schipper et al., 2015)
<i>Growth Mindset Interventions</i>	Students learn intelligence is malleable and write reflections or advice about overcoming challenges.	↑ GPA ↑ enrollment rates ↓ achievement gap	(Yeager & Dweck, 2020)
<i>Difference-Education Intervention</i>	FG students learn how senior students overcome their challenges to be successful.	↑ GPA ↓ anxiety	(Stephens et al., 2014)
<i>Transitional Difficulties Intervention</i>	Frames transition-related performance-declines as normal and transient.	↑ GPA ↑ retention	(T. D. Wilson & Linville, 1985)

Conclusion

Instructors teach students, not topics, and therefore they have the responsibility to do whatever is in their power to improve student experiences and outcomes. They can work towards reducing the achievement gaps

in their own classrooms by using, adapting, and building on the approaches detailed above. Most of these strategies and interventions are free and require only a small amount of time. Making an inclusive classroom is a lifelong process rather than a 'one and done' exercise.

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Recommendations in the primary literature may change or become more refined with time. Instructors should collect and analyze their own student performance and opinion data to monitor the effectiveness of whatever interventions, activities, and

strategies they are using. Because learning is a complex task, any individual intervention is not likely to have a large effect on student learning gains. By testing and (where appropriate) combining different interventions instructors can find the best way to eliminate the achievement gap in their classrooms.

GLOSSARY

Academic Achievement Gap: Academic performance differences between different populations of students.

Active learning: A process through which students actively engage with and reflect upon course content. It may involve several different techniques, activities, and strategies, such as clicker questions or think-pair-shares.

African Americans: US citizens whose ancestors came from Africa and lived in the USA before or during the transatlantic slave trade.

AHN: African Americans/Blacks, Hispanic/Latino(a), and Native Americans/Alaskan Natives

Anxiety: A mental state characterized by a variety of symptoms which vary in intensity and frequency. Symptoms include nervousness, uncontrollable worry, restlessness, sweating, trembling, insomnia, and the inability to maintain focus.

Belonging: An affinity for a place, situation or group; a feeling that you are welcome and ‘fit in’.

Bias: Prejudice against one thing, person or group. Usually it is considered to be unfair.

BIPOC: Black, Indigenous, and other People of Color

Black: People with dark skin pigmentation, most of whom have African ancestry.

Blocking: A method of studying where students focus exclusively on a single topic for the majority of the study session.

Career Achievement Gap: Refers to income and employment gaps between majority and minority populations.

Classroom communication apprehension (CCA): the fear of being inadequate in front of professors or peers. It affects about 70% of students at least some of the time.

Cold Calling: Calling on a student to publicly answer a question in front of the class without them first volunteering.

Colorblindness: A misguided ideology that emphasizes sameness and postulates that individuals have the same opportunities and should thus be treated equally regardless of their starting circumstances.

Continuing Generation (CG) students: Students who have at least one parent with a degree from a 4-year college.

Cultural mismatch: Difficulties conversing-with and relating-to groups who have norms, experiences, and cultural values that are different from our own.

DEI: Diversity, Equity, and Inclusion

First generation (FG) students: Students whose parents do not have a degree from a 4-year college.

Fixed mindset: The idea that a person’s intelligence is unchangeable.

Generational Wealth and income (GWI): Refers to the amount of generational wealth and household

income a person possesses. Considered to be more respectful and than the “socioeconomic status (SES)” while maintaining the same meaning.

Growth Mindset: The belief that people can increase their intelligence with effort and practice.

Hispanic: People descended from Spanish-speaking populations. (e.g. someone from Spain).

Intersectionality: Describes how all aspects of an individual’s identity (i.e., class, race, gender, religion, sexual orientation etc.) are meaningful and worthy of consideration when trying to understand a given person’s experiences and challenges.

Instructor Immediacy: Behaviors that reduce the perceived distance between students and instructors and make the instructor seem more present and accessible.

Implicit Bias: Refers to unconscious attitudes, beliefs, or stereotypes that can affect our actions, decisions, or thoughts about certain groups.

Imposter Phenomenon: Occurs when high-achieving individuals fail to internalize their success and accomplishments, have self-doubt that they belong where they are, and fear being exposed as an imposter.

Intellectual Marginalization: Phenomenon through which women and students of color may have their ideas ignored during teamwork.

Latinx: Latin America, which includes South America, Central America, the Caribbean, and Mexico, is so named because it’s inhabitants primarily speak Spanish and Portuguese, two languages derived from Latin. Latino is used for males, Latina is used for females, and Latinx can be used for either, for those of non-binary gender, or for mixed groups of both genders.

Metacognition: Awareness and self-reflection about one’s own thinking, learning strategies, and performance.

MGS: Minoritized Groups in STEM. Includes both underrepresented minorities and students with a low generational wealth and income.

Microaggressions: Short, often subtle, statements or actions that consciously or unconsciously disparage others based on their background, personal characteristics, race, ethnicity, or perceived group membership.

Microaffirmations: Occur when the instructor uses positive language to increase inclusion, build relationships, and encourage students.

Mindset: A person’s mindset describes whether they believe intelligence is fixed (i.e. fixed mindset) or malleable (i.e. growth mindset).

Native Americans: Indigenous peoples whose ancestors lived in the Americas prior to European colonization.

Non-transfer student: A student who has done all of their undergraduate education in a single institution.

Multiculturalism: Ideology that acknowledges racial, ethnic, and cultural differences and views them as a strength.

PEERS: Persons excluded because of their ethnicity or race.

POC: People of color. Refers to all people who are not White/Caucasian.

Psychosocial intervention: Activities that interrupt negative recursive behaviors (e.g. feeling like a failure can lead to more failing) in order to improve health and well-being.

Racism: Prejudice and/or discrimination directed against groups of people with a particular skin color or ethnic background.

Self-efficacy: The belief someone has in their own ability to succeed.

Stress: Feelings of pressure, frustration, and mental discomfort that occur when an individual feels overwhelmed and unable to adequately cope with their current situation.

Social anxiety: The fear of embarrassment in social performance situations, affects about 13% of people.

Social-Psychological Factors: Also known as non-cognitive or affective factors, include interest in science, science identity, science career aspirations, attitudes, beliefs, confidence, belonging, attention, self-discipline, self-esteem, enthusiasm, effort, responsiveness, ethnicity stigma conscious (ESC, a measure of stereotype threat), and anxiety.

Socioeconomic status (SES): Refers to the amount of generational wealth and household income a person possesses.

Stereotype: A widely held belief about a particular group of people.

Stereotype threat: Occurs when students are conscious of stereotypes about their social group and either believe these stereotypes are true, or fear their actions might inadvertently confirm and perpetuate negative stereotypes about their group.

Stigmatization: Public disapproval, shame, and/or unfair treatment due to someone's status as a member of a particular group. For example, there is a lot of stigmatization against those with mental health issues which can make them feel ashamed and decrease the chances that they will seek medical help for their conditions.

Task Assignment Bias: When students assign tasks to themselves or others it can result in women and students of color being assigned tasks that are less considered valuable or desirable.

Test anxiety: Involves the fear of performing poorly on exams, quizzes, or other assessments, affects about 38.5% of students.

Transfer shock: Performance decline following a transfer from one institution to another. Often accompanied by feelings of being overwhelmed.

Transfer student: A student who transferred from one undergraduate institution into another.

Unlevel playing field: Refers to the unfair or inequitable starting conditions or circumstances when comparing two or more populations.

URM: Underrepresented minority, does not include Asians, women, people with mental or physical disabilities, or anyone from the LGBT community unless they are also an underrepresented racial minority. This label can be applied to all students that fit the description or to an individual student included within that category.

Utility-value: How useful students find a particular topic or exercise to their lives and future career aims.

Vertical Transfer: When a student transfers from a 2-year to a 4-year institution.

Warm calling: Involves asking students to work on answers as a group and then report their group's answer (or something they heard during the discussion) in order to take the pressure off the individual student.

White/Caucasian: Historically it referred to people with light skin pigmentation of predominantly European ancestry. Racial terms such as these are now considered to be obsolete as they are based on the disproven biological theory of race.

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