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STEREOTYPE THREAT

Overview, Current Trends in Research, and Interventions to Bolster Achievement and Learning

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Stereotype Threat: An Introduction

Various theories have been proposed to explain the underperformance and lack of representation of women in science, math, engineering, and technology (STEM), especially at the highest levels. Stereotype-based arguments—either the content of the stereotype suggesting that women lack mathematics ability compared to men, or the existence of the stereotype itself as a culprit in the hamstringing of women's mathematics accomplishments—arise as likely culprits. Others point to a 'culture of talent' in STEM—the widespread belief that some people have it and others do not. These ideas, which have been present for centuries, persist and contribute to achievement gaps for women and other negatively stereotyped groups through a process known as 'stereotype threat.'

Stereotype threat (Steele & Aronson, 1995)—the concern one feels about potentially confirming stereotypes and judgements about people's abilities—derives from societal beliefs suggesting that some groups are better than others (e.g., smarter, more athletic, better leaders) and that these differences have genetic roots. Situations in which the stereotype is relevant, and thus potentially confirmable, create concerns for the individual that their behaviours could confirm the societal stereotypes about the stigmatised group(s) to which they belong. The resulting emotional tax of potentially fulfilling the stereotype leads to a (temporary) depletion of resources that can lead to the very deficits suggested by the stereotype (Pennington et al., 2016).

Stereotype Threat and Academic Performance

Steele and Aronson's (1995) seminal work on stereotype threat showed that Black Americans underperformed on standardised tests compared to White Americans when students took difficult tests that were framed as diagnostic of underlying intelligence (e.g., SAT or Graduate Record Exam), and when they indicated their racial-group membership prior to solving difficult problems. Furthermore, cultural stereotypes were activated for Black (but not White) students under these diagnostic conditions. Because the framing of the task and the act of

identifying racial-group membership affected only the performance of Black students, and because these procedures activated race-based stereotypes only for Black students, these situations created identity threats related to the experience of being a Black person in American society and, specifically, to the stereotype that Black people are intellectually inferior to White people.

Since that seminal study, stereotype threat has been implicated in the achievement gaps for women's STEM performance (Spencer et al., 1999), Latinos' verbal performance (Gonzales et al., 2002), low-socioeconomic-status students' verbal performance (Croizet & Claire, 1998), and girls' mathematics performance as early as sixth grade (Good et al., 2003).

Stereotype threat is not just a laboratory phenomenon; it also has been implicated in classroom performance. For example, in a mathematics classroom context, men and women performed equally well in the stereotype threat condition; however, women outperformed men in the non-threat condition (Good et al., 2008). This unexpected finding could be explained by a predominance of high-achievement women in mathematics self-selecting into the class, and, thus, female students under the non-threat condition performed better than men because removing the threat allowed them to perform to their potential. Interestingly, course grades mirrored the pattern of performance in the stereotype threat condition—no differences were found between men and women, suggesting that stereotype threat may have been operating within the classroom environment to suppress women's classroom performance.

Stereotype Threat and Learning

Stereotype threat can also undermine learning. Research using visual search paradigms in laboratory settings shows a nearly flat learning curve under stereotype threat conditions and an improved learning curve under non-threat conditions (Rydell & Boucher, 2017). In a learning context that more closely resembles how classroom learning proceeds, Good et al. (2003) showed that stereotype threat reduced females' (but not males') mathematics learning engagement, which resulted in a gender gap in learning outcomes. When the threat was removed, both learning engagement and learning outcomes remained high for both males and females. Similarly, Black students have also been shown to have worse learning outcomes due to stereotype threat (Taylor & Walton, 2011).

Together, these studies show that stereotype threat disrupts not only intellectual performance, but also learning. Over time, differences in learning could result in real differences in knowledge, thus reinforcing cultural stereotypes. Furthermore, stereotype threat can affect people on many important outcomes separate from performance and learning, such as disengagement and disidentification with stereotyped domains (Von Hippel et al., 2011), feeling of uncertain belonging (Thoman et al., 2013), and reduced motivation to persist in such environments (Good et al., 2012).

Stereotype Threat Mechanisms and Processes

Contexts in which salient negative stereotypes are associated with a stigmatised group have been associated with various psychological, physical, and cognitive processes that in turn predict performance and learning differences. This section describes these mechanisms.

Arousal and Anxiety

Arousal (i.e., a heightened state of physiological and psychological excitement) and anxiety (i.e., negatively valenced arousal) influence performance: too much can overwhelm and impoverish essential cognitive resources, while too little can lead to disengagement and dis-interest in executing a cognitive goal. Importantly, heightened arousal and anxiety have been implicated as key mechanisms in stereotype-based underperformance. For example, the attri-butions people make for the source of their anxiety and arousal implicate stereotype threat processes at work (Inzlicht & Ben-Zeev, 2003). When female college students reappraised the source of arousal and anxiety experienced during a mathematics test under stereotype threat conditions as external rather than internal, the effects of stereotype threat on test performance were fully attenuated. Had stereotype threat been purely related to test anxiety, and not specific to stereotype-relevant anxiety, female students should have performed worse regardless of the source of anxiety (Inzlicht & Ben-Zeev, 2003).

Stereotype-Related Thought Suppression

In addition to anxiety and arousal, stereotype threat induces negative thoughts and feelings, which people attempt to inhibit to focus on goal-relevant information. Ironically, efforts to suppress threatening thoughts deplete the very same cognitive and attentional resources needed to develop effective solutions and perform optimally. For example, both women's suppression of threatening thoughts cued by men's sexist behaviour (Logel et al., 2009) and stigmatised groups' suppression of threat-induced thoughts (Carr & Steele, 2009; Johns et al., 2008) have been shown to compromise performance in a range of contexts. Therefore, attempting to suppress the negative thoughts triggered by stereotype threat often has the ironic effect of further inhibiting one's ability to perform to their potential.

Physiological Responses

In addition to psychological and cognitive consequences, stereotype threat also affects phys-iological outcomes for stigmatised groups (e.g., Blascovich et al., 2001; Croizet et al., 2004). Physical manifestations of psychological stress include increased heart rate and galvanic skin response, which are symptoms of the activation of the sympathetic nervous system (SNS). Stereotype threat activates the SNS in ways that mimic physiological stress responses, which increase the risk of certain negative health outcomes. For example, women who watched a 7-minute video that depicted an underrepresentation of females in STEM experienced greater physiological stress responses (greater cardiovascular and electrodermal activation) than men (Murphy et al., 2007). No difference in stress reactivity between men and women was found when the video represented gender equality. Stereotype threat may also have consequences for long-term physical and mental health (John-Henderson et al., 2015).

Emotional Responses and Regulatory Processes

Because negative stereotypes suggest that failure is likely, the threat of that potential failure could trigger maladaptive emotional responses that ultimately undermine learning engage-ment and learning outcomes. For example, Mangels et al. (2012) found that neural activity associated with emotional sensitivity to and vigilance for negative feedback under stereotype

threat conditions predicted less engagement with an online tutor designed to help students learn from their mistakes, which in turn predicted poor learning. They also found that the neural correlates of emotion-based rumination predicted poor learning, regardless of tutor engagement. Given these findings, stereotype threat appears to disrupt learning by levying an emotional tax that comes with a cost in the form of poor emotion regulation, withdrawal from learning opportunities, and ineffective use of learning resources.

Working Memory

Optimal cognitive performance requires adequate working memory resources (e.g., attention, processing, and self-regulation, among others). Yet, each of the mechanisms described earlier requires cognitive processes to manage it. And when cognitive processes are diverted to task irrelevant goals, fewer cognitive resources are available for the task at hand. It is likely that stereotype threat disrupts optimal performance, in part, because it depletes working memory resources (Schmader et al., 2008). For women taking mathematics tests, and Latino students taking verbal tests, working memory resources not only decreased under stereotype threat conditions, but also mediated the effects of stereotype threat on academic achievement such that decreased working memory capacity was associated with poorer mathematics performance (Schmader & Johns, 2003). Additional evidence suggests that stereotype threat undermines performance, not by *reducing* working memory per se, but by *diverting* working memory resources to task irrelevant activities (Beilock et al., 2007). Furthermore, when stereotype threat disrupts the working memory process, spillover effects can occur in which task performance decreases even for tasks unrelated to the stereotype (Beilock et al., 2007; Inzlicht & Kang, 2010). In other words, stereotype threat results in reduced performance because it disrupts optimal working memory, which compromises resources that are necessary to arrange cognitive processes, manage goal-relevant behaviour, and ignore irrelevant/distracting information.

An Integrated Process Model

In the article 'An Integrated Process Model of Stereotype Threat Effects on Performance' (Schmader et al., 2008), a model is used to illustrate how various processes work together to undermine achievement (to view the full model and its pathways, see Schmader et al., 2008, p. 337). Importantly, the model hinges on the importance of working memory: depleted or misdirected working memory stymies performance on cognitive and social tasks (path *a*) (Schmader & Johns, 2003). The process is set into motion when stereotype threat is triggered by any one of several factors that make the stereotype salient, such as coupling performance and intelligence on cognitive tasks (Steele & Aronson, 1995), numerical underrepresentation (Inzlicht & Ben-Zeev, 2000, 2003), salience of one's stigmatised identity (Steele & Aronson, 1995), and ingroup members' stereotypical behaviour (Cohen & Garcia, 2005). Stereotype threat then causes physiological stress responses (path *b*) (e.g., Blascovich et al., 2001), which deplete or distract working memory (path *c*) (Schmader & Johns, 2003). It also causes increased self-monitoring processes (path *d*) (Beilock et al., 2007), which further render working memory inefficient (Conway et al., 2001) by replacing performance-relevant information with performance-irrelevant information (path *e*).

Simultaneously, a bidirectional relationship between stereotype threat and a feedback loop (path *f*) consisting of negative thoughts (Cadinu et al., 2005), appraisals (Stangor et al.,

1998), and negative emotions (Mangels et al., 2012) occurs. Physiological stress responses (path *g*) and monitoring processes (path *h*) perpetuate this bidirectional feedback loop. Adding to this vicious cycle, victims of stereotype threat might attempt to suppress stereotype-related thoughts (Wegner et al., 1993), which, ironically, further intensify those same thoughts and cause even more thought suppression (path *i*), which again further taxes working memory (Wenzlaff & Wegner, 2000). Insidiously, this thought suppression process also further causes increased physiological stress responses (path *k*) (Mendes et al., 2003) and self-monitoring (path *l*) (Wenzlaff & Wegner, 2000). Finally, increased self-monitoring causes deficits in automatic processing (path *m*) (Jamieson & Harkins, 2007). The integrated process model provides a compelling and useful holistic view of the inner workings of stereotype threat.

Critiques and Meta-Analyses of the Stereotype Threat Literature

Although decades of stereotype threat research have yielded many compelling findings, criticisms remain. Some of these include the arguments that (a) stereotype threat is overstated and does not completely explain the racial gap in performance on standardised testing (Jussim et al., 2015; Sackett et al., 2004); (b) stereotype threat is a form of measurement bias (Wicherts et al., 2005); and (c) stereotype threat suffers from publication bias (Flore & Wicherts, 2015).

For each of these criticisms, researchers have been able to provide convincing counterpoints. First, Steele and Aronson (1995) never claimed that stereotype threat fully accounted for the racial test-score gap. That multiple factors likely contribute to the racial test-score gap does not lessen the importance of studying stereotype threat. Stereotypes are ever present, meaning the potential for threat remains.

Second, measurement bias does not account for stereotype threat effects on test performance because the criteria for measurement invariance (Wicherts et al., 2005) is met in stereotype threat studies. Specifically, males and females do not differ in the way the measurement of the construct (e.g., mathematics test score) relates to the latent construct (e.g., mathematics ability). Indeed, this is exactly the outcome in non-threat conditions across multiple studies (e.g., males and females do not differ on mathematics tests). Thus, the standard for measurement invariance is met, and thus the argument for measurement bias falls short.

Third, the criticism related to publication bias has been addressed through several meta-analyses, which synthesise evidence in both published and unpublished studies and use criteria-based standards for including or excluding a study from the analysis. These results consistently find the overall effect of stereotype threat to be significant and robust (Nguyen & Ryan, 2008; Shewach et al., 2019; Walton & Cohen, 2003, 2007) with effect sizes ranging from $d = .14$ to $d = .33$. Furthermore, relatively few issues of publication bias have been identified. In fact, meta-analyses have shown that stereotype threat can account for 50% to 82% of the gender gap and 17% to 41% of the racial gap between underrepresented minorities and White people on SAT scores (Spencer et al., 2016; Walton et al., 2013).

Stereotype Threat Interventions

Stereotype threat researchers continue to refine the conceptualisation of the construct, the conditions under which it can disrupt educational outcomes, and the processes by which it does so. Importantly, the research community has expanded its inquiry to better understand

interventions to reduce the effects of stereotype threat and has partnered with educators to implement those interventions in classrooms. In this section, we summarise some of the most promising interventions.

Growth Mindsets

At the heart of ability impugning stereotypes is the (false) idea that a person is inherently limited in their ability and intelligence because of their social identity. In part, the idea of fixed, limited ability fuels stereotype threat effects on learning and achievement. These 'fixed mindsets' manifest in behavioural outcomes, such as goals that students pursue, appraisals of failures, the role of effort in outcomes, strategies in response to difficulties, and ultimately learning and achievement, especially when faced with challenges or failures (for a review, see Dweck & Yeager, 2019).

In addition to these important behavioural outcomes, researchers are beginning to show that the focus on proving rather than improving ability also affects the neural correlates of learning. For example, in response to negative feedback, researchers found that those with a fixed mindset showed less learning-related neural activity than those with a growth mindset (Moser et al., 2011), perhaps due to differences in attention processing for fixed and growth mindset individuals when presented with negative feedback (Mangels et al., 2006).

The Malleability of Mindsets: Harnessing Growth Mindsets to Combat Stereotype Threat

Stereotype threat may situationally induce a fixed mindset (Aronson et al., 2002) because ability impugning stereotypes raise the spectre of fixed, limited ability. This suggests that encouraging students to adopt a growth mindset could protect against negative stereotypes. Aronson et al.'s (2002) technique of teaching students about neuroplasticity (i.e., that intelligence is malleable), coupled with other forms of attitude change, has been shown to be an effective mindset intervention. Studies leveraging growth mindsets have reduced the gender gap on standardised mathematics tests for middle school students (Good et al., 2003) and the achievement gap for Latino and White students on standardised verbal tests (Gonzales et al., 2002) and increased Black college students' grade-point average (GPA) compared to control groups (Aronson et al., 2002).

Belonging Interventions

Stereotypes imply more than simply who has or does not have ability. They also carry implications for who belongs in a domain of study. Meaning, stereotypes also shape belonging mindsets—whether one feels like an accepted member of an academic community, whose presence and contributions are valued (Good et al., 2012). Whereas past research has highlighted belonging as a fundamental need (Baumeister & Leary, 1995) and elevated the importance of social belonging (e.g., Walton & Cohen, 2007), feelings of belonging to an academic domain are also critical (Steele, 1997), especially for learning and motivation (Good et al., 2012). Unfortunately, stereotype threat introduces risks for both underperformance and underrepresentation, specifically because stereotypes raise questions about one's rightful place in the discipline (Good et al., 2012). Environmental cues can make stereotypes salient, leading to lowered trust within that context (Purdie-Vaughns et al., 2008)

and reduced sense of belonging for members of negatively stereotyped groups (e.g., Cheryan et al., 2009; Murphy et al., 2007; Walton & Carr, 2012). In other words, a sense of belonging may be especially fragile for negatively stereotyped students.

However, bolstering feelings of belonging presents another potential intervention to reduce stereotype threat. When sense of belonging to mathematics was manipulated, females reported a greater sense of belonging to mathematics and a greater intent to pursue mathematics in the future (Good et al., 2012). Furthermore, directly encouraging a high sense of belonging also led to deeper engagement with a learning task and protected females from low mathematics learning due to stereotype threat (Good et al., 2015). Similarly, Walton and Cohen (2007, 2011) reported GPA increases over a 3-year period for African American college students participating in a brief belongingness intervention. These studies suggest that explicitly fostering feelings of belonging can, like growth mindsets, protect against stereotype threat.

Affirmation Interventions

Like the fundamental need to belong, people have a fundamental need to maintain self-integrity (i.e., a general sense of personal adequacy). When events threaten one's self-integrity—performing poorly in school, facing cultural stereotypes suggesting limited intelligence—stress swells and self-protective defences take root, often leading to maladaptive behaviours and poor outcomes. Affirming the self, thereby repairing and fortifying one's self-integrity, can reduce stress and stave off the resulting negative outcomes (Cohen & Sherman, 2014). The lynchpin of self-affirmation interventions involves having people write about a core personal value. Doing so expands the view of the self, reminds them of their valued resources, and fortifies personal integrity, thus reducing stress. Self-affirmations have been associated with improved outcomes across multiple domains, including education, health, and relationships.

Sherman and Cohen (2006) capitalised on self-affirmation research to design an intervention targeting one of the primary mechanisms connecting stereotype threat to underperformance: stress. The researchers found that values affirmations reduced the GPA gap between Black and White students by 40%. Values affirmations led to similar effects for women experiencing stereotype threat in mathematics and improved women's (but not men's) spatial rotation performance under stereotype threat conditions (Martens et al., 2006). Research also indicated that values affirmations may have long-term benefits in reducing achievement gaps for Black students (Cohen et al., 2009). Providing stereotyped individuals a pathway to maintain their self-integrity, even in the face of integrity-debasing stereotypes, seems to serve as an effective and promising stereotype threat intervention.

Creating Classroom Cultures to Combat Stereotype Threat

Much of the past interventions have focused on students. But research suggests that teachers and the classroom cultures they create may be even more effective for combating stereotype threat. Importantly, teacher mindsets affect students' motivation and investment in learning (Rattan et al., 2012), perhaps because teaching practices that lead to effective learning are often predicated on teachers' growth mindsets. For example, fixed-mindset teachers compare students to each other (normative evaluations), whereas growth-mindset teachers are more likely to consider personal improvement (individual evaluations) as indicators of students' learning (Butler, 2000). Teacher mindsets also moderate the type of feedback they endorse

for struggling students (Rattan et al., 2012). Compared to teachers with a growth mindset, fixed-mindset teachers are more likely to see student struggles as indicative of fixed, underlying mathematics ability, assigning them counterproductive (i.e., less challenging) work. Alternatively, growth-mindset teachers are more likely to endorse teaching practices that subtly convey their beliefs that intelligence can be increased with effort, engagement, and productive persistence.

Additionally, students accurately perceive teachers' fixed versus growth mindsets from the classroom discourse used while teaching (Good et al., 2003). For example, when lessons were embedded with fixed-mindset messages, students were more likely to perceive that the teacher believed intelligence to be a fixed trait (Good et al., 2003). Similarly, a field study by Muenks et al. (2020) showed that college students taking STEM courses with college professors exhibiting fixed mindsets demonstrated greater psychological vulnerability—lower reported belonging, greater feelings of being an imposter, increased negative affect, and greater evaluative concerns. This psychological vulnerability not only undermined students' performance in the class, but also resulted in their taking fewer classes, being less engaged in class, receiving lower grades, reporting greater intentions to drop out of STEM, and reporting decreased intentions to pursue future STEM classes. Furthermore, when females in advanced mathematics perceived a growth-mindset classroom culture rather than a culture of talent, they reported greater feelings of belonging, which in turn predicted greater intention to remain in mathematics and higher mathematics grades (Good et al., 2012). Similar results were found for Black and Latinx/Hispanic students in STEM when their faculty members endorsed a growth mindset rather than a fixed mindset (LaCosse et al., 2020).

Emerging research using experimental designs supports the hypothesis that a classroom culture focused on effort and engagement reduces the impact of stereotype threat compared to talent-based classroom cultures. For example, Good et al. (2003) experimentally created mathematics learning cultures focused on either fixed-mindset messages or growth-mindset messages and then gave students mathematics tests under stereotype threat or non-threat conditions. They found that stereotype threat led to a gender gap in mathematics performance in the fixed-classroom culture such that girls performed worse than boys on the mathematics test. However, in the growth-classroom culture, boys and girls performed equally well, even under stereotype threat (Good et al., 2003). Importantly, learning in a fixed-classroom culture and performing under stereotype threat conditions led to the worst mathematics outcomes for girls. Furthermore, the growth-classroom culture also protected girls' sense of belonging and mathematics engagement from the effects of stereotype threat—these outcomes were highest in the non-threat, growth-classroom condition. This suggests that the best way to engage students in learning is to remove threatening stereotype-based stimuli and create an effort-based, growth-mindset classroom culture (Good et al., 2003).

Taken together, these studies highlight the important role that teachers' mindsets about the nature of intelligence can play in creating classroom cultures that can reduce the effects of stereotype threat and positively affect students' sense of belonging, motivation, learning, and achievement.

Conclusions

Cultural stereotypes that tie abilities to social identities continue to exist in society, and both laboratory and field-based studies have shown that stereotype threat is an ongoing phenomenon that continues to undermine motivation, achievement, and learning. Interventions to

reduce the effects of stereotype threat have traditionally focused on students—shifting students' mindsets in stereotyped domains away from the view of innate intelligence, instilling a hardy sense of belonging, or encouraging students to focus on their cherished values. But this focus on students may be short-sighted, because it ignores the culture in which students are asked to learn and demonstrate their knowledge as well as the systemic processes that continue to perpetuate stereotypes and create the very cultures that students are attempting to protect themselves against.

Instead, interventions that focus on classroom cultures, and the role that teachers play in creating contexts in which the effect of societal stereotypes can be mitigated, are promising and effective interventions. And as laboratory studies, applied field studies in schools, and large international studies have shown, encouraging students and teachers to adopt a growth mindset and to strengthen their feelings of belonging and importance in academia has the potential to reduce race and gender gaps in school and on tests. But, perhaps more importantly, when these ability and belonging mindsets are embedded within a classroom culture, they can create the conditions for learning that will allow all students not just to succeed, but to thrive, unburdened by stereotypes and a culture of talent.

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