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Keywords

Stereotype Threat, Self-Affirmation, Executive Functioning

STEREOTYPE THREAT AND SELF-AFFIRMATION: RECONSIDERING THE PROTECTIVE INFLUENCE OF VALUE AFFIRMATION INTERVENTIONS

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Abstract

The current study was designed to examine the influence of self-affirmation on learners' executive attention and mathematical performance when confronted with stereotype threat. Participants (N = 206) were exposed to self-affirmation and stereotype threat manipulations, completed operation-span and letter memory tasks, and a series of high-difficulty modular subtraction problems. Our results revealed that self-affirmed participants demonstrated lower mathematical performance when problems were completed under high stereotype threat conditions. Further, our data revealed the self-affirmation and stereotype threat manipulations had no impact on components of executive attention hypothesized to underlie stereotype threat effects. These findings add to recent literature calling into question the viability of self-affirmation as a strategy for protecting at-risk students' achievement.

Introduction

Stereotype threat theory is a psychological framework emphasizing the role of stereotypes in students' academic underperformance (Flore & Wicherts, 2015; Spencer et al., 2016; Steele & Aronson, 1995). The theoretical framework assumes that learners who identify as members of a group for who societal stereotypes are pervasively negative in specific contexts will encode situational cues in those contexts that activate awareness of those negative stereotypes (Aronson, 2002). Increased awareness of negative stereotypes is believed to activate maladaptive cognitive, behavioral, and affective reactions that interfere with information processing and go on to undermine performance on tasks that are associated with the stereotype (Brubaker & Naveh-Benjamin, 2018; Croizet et al., 2004; Schmader & Johns, 2003; Schmader et al., 2008). Following the first empirical demonstration of stereotype threat in the literature (Steele & Aronson, 1995), researchers have reliably demonstrated that stereotype threat is associated with reduced academic performance among learners who identify strongly with stigmatized social groups (Nguyen & Ryan, 2008; Picho & Schmader, 2018; Spencer et al., 2016). Given the association between stereotype threat and academic achievement, researchers have worked to develop intervention methods with the potential to protect the academic performance of learners most susceptible to stereotype threat. One of the most promising intervention techniques identified in the literature involves asking learners to reflect on important personal values, a self-affirmation (Cohen & Sherman, 2014). Despite the existence of empirical findings demonstrating the benefits of self-affirmation when confronted with stereotype threat (Mertens et al., 2006; Tailandier-Schmitt et al., 2012), relatively little is known about the causal mechanisms that contribute to the protective benefits of self-affirmation exercises (McQueen & Kline, 2006). In the present study, we attempt to address this gap in the literature by examining

the influence of self-affirmation on two components of executive attention that have been implicated in stereotype threat effects, intentional maintenance and disengagement.

Stereotype Threat and Executive Attention

A sizable body of empirical literature has demonstrated that stereotype threat, which manifests as the fear that ones' behavior will be judged stereotypically or will reflect poorly on in-group members, can negatively influence academic performance (Nguyen & Ryan, 2008; Steele, 1997; Steele & Aronson, 1995). Available evidence implicates executive attention, a limited capacity system responsible for the allocation of attentional resources and regulation of goal-directed behavior, as the key mediator of the relationship between stereotype threat and performance (Beilock et al., 2007; Schmader & Beilock, 2012; Schmader & Johns, 2003, Spencer et al., 2016). Contemporary theoretical frameworks assume that there are two primary executive functions responsible for allocating attentional resources. Focusing attention is proposed to increase the durability of important information by protecting against sources of interference while simultaneously allowing for the inhibition of task-irrelevant information (Engle, 2002; Shipstead et al., 2016). The first executive function is intentional maintenance and refers to the effortful focusing of attentional resources on task-relevant stimuli (Shipstead et al., 2016). The second executive function, known as intentional disengagement, or memory updating, is responsible for removing information from active processing. Intentional disengagement decreases the probability that attentional resources will be devoted to processing outdated and potentially irrelevant information (Shipstead et al., 2015; Shipstead et al., 2016).

Empirical investigations have demonstrated that efforts to regulate the maladaptive responses that follow from the activation of negative stereotypes interfere with the effective allocation of attentional resources required for success on stereotype-relevant tasks (Murphy et al., 2007; Schmader et al., 2008). Although cognitive interference accounts of stereotype threat effects have received empirical support (Bedynska et al.,2020; Beilock et al., 2007; Schmader & Johns, 2003; Schmader et al., 2008), research into the specific mechanisms through which stereotype threat interferes with information processing is still in its infancy. Our review of the existing literature identified that most stereotype threat research has focused on the influence of stereotype activation on the intentional maintenance component of executive attention (Shipstead et al., 2016). However, our review of the literature revealed only one study that has explored the influence of stereotype threat on working memory capabilities (Rydell et al., 2014). In their research, Rydell and colleagues (2014) demonstrated that stereotype threat reduces mathematical performance by disrupting learners' memory updating capabilities (i.e., the ability to monitor replace irrelevant information in working memory; Miyake & Friedman, 2012; Morris & Jones, 1990). We believe there is value in additional research on the causal mechanisms involved in stereotype threat effects. The effectiveness of intervention efforts is directly dependent on our ability to address the unique challenges confronting learners who identify with traditionally stigmatized social groups.

Self-Affirmation and Stereotype Threat

Stereotype threat theory assumes that self-integrity is integral in determining individuals' susceptibility to stereotype threat (Steele, 1997). This general assumption is supported by empirical evidence suggesting that stereotype threat is most likely to occur among those who place considerable value on performance in a stereotyped domain and use their performance to

guide self-evaluative judgments (Aronson et al., 1999; Spencer et al., 1999). Because of the proposed role of self-integrity in stereotype threat, researchers have begun investigating the viability of intervention methods designed to protect one's sense of self-integrity. Most of these intervention efforts attempt to enhance self-integrity by asking learners to engage in self-affirmation. In this process, individuals manage self-image threats by reflecting on important personal characteristics (Cohen & Sherman, 2014). Self-affirmation is believed to restore or preserve self-integrity by providing individuals the opportunity to consider domains of their life that solidify their sense of agency over important life outcomes (Cohen & Sherman, 2014; McQueen & Klein, 2006). Perceptions of personal agency and general competence play a critical role in individuals' responses to stressful situations. Specifically, individuals with a strong sense of personal agency or self-efficacy are more likely to view challenging performance situations as obstacles to be overcome and subsequently utilize active coping strategies to devote high-quality effort to task completion (Sherman & Hartson, 2011).

A review of the existing literature highlights that reflecting on important personal values is associated with short-term improvements in performance among those confronted with stereotype threat in controlled laboratory settings (Mertens et al., 2006). Perhaps most importantly, available evidence suggests that brief self-affirmation exercises are associated with enduring performance improvements among learners in K – 12 and collegiate settings who are believed to routinely contend with feelings of stereotype threat (Cohen et al., 2006; Cohen et al., 2009; Hadden et al., 2020; Tailandier-Schmitt et al., 2012).

Despite empirical evidence supporting the efficacy of self-affirmation interventions among those confronted with stereotype threat, the causal mechanisms contributing to self-affirmation exercises' protective influence are poorly understood (Harris et al., 2016; McQueen & Klein, 2006). Early work exploring the causal mechanisms contributing to self-affirmations benefits emphasized the role of affective and motivational states. Specifically, theorists suggested that self-affirmation enhances performance by influencing self-esteem (Kimble, Kimble, & Croy, 1988; Stone & Cooper, 2003), positive mood (Koole et al., 1999), and physiological stress response (Creswell et al., 2005). However, following metanalytic work that called into question the role of affective constructs in self-affirmation effects (McQueen & Kline, 2006), researchers have shifted their focus toward understanding how broad cognitive factors contribute to the facilitative effects of self-affirmation (Harris, Harris, & Miles, 2016; Legault, Al-Khindi, & Inzlicht, 2012; Logel & Cohen, 2012). Because self-affirmation is associated with a diverse range of positive outcomes, some have suggested that learners' attention to personally-important attributes enhances their domain-general abilities that positively influence responses to environmental cues and formulate goals and strategies to attain desired outcomes (Logel & Cohen, 2012). In support of this proposition, a growing body of literature has demonstrated that self-affirmed individuals show improved cognitive control (Hall, Zhao, & Shafir, 2014), working memory efficiency (Logel & Cohen, 2012), and inhibition (Harris et al., 2016).

Current Study

Self-affirmation exercises have been shown to protect learners' performance with stereotype threat (Sherman et al., 2013; Spencer et al., 2016). Recent work has provided preliminary evidence that self-affirmation may facilitate performance by enhancing executive attention and control processes (Hall et al., 2014; Harris et al., 2016; Logel & Cohen, 2012). However, no study to date has explored if self-affirmation benefits those confronted with

stereotype threat by protecting or restoring executive attention capabilities. Therefore, the current research's primary goal is to address this gap in the stereotype literature by investigating if the facilitative influence of self-affirmation among learners confronted with stereotype threat is associated with enhanced executive attention capabilities, specifically examining intentional maintenance and intentional disengagement.

Method

Participants

A review of the existing literature indicates the magnitude of stereotype threat effects is generally small (Nguyen & Ryan, 2008; Walton & Cohen, 2003). Using Cohen's (1992) guidelines for interpreting the magnitude of effect sizes, we determined values corresponding to the upper and lower bounds of "a small effect size" for the f^2 effect size index. A series of a priori power analyses were then conducted using the G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the sample size necessary to replicate effects with magnitudes falling within the identified effect size range. Results indicated approximately 264 participants would be required to detect an effect with a magnitude at the lower bound, and 44 participants would be needed to detect an effect with a magnitude at the upper bound with an alpha .05 for a study with .80 power. Therefore, data were collected from 206 participants with approximately equal numbers in each condition to ensure adequate statistical power in the current study.

Participants (N = 206, $\overline{M}\ Age = 19.18, SD = 1.49, 85\%\ Caucasian$) were undergraduate female students attending a mid-sized public university located in the Midwestern United States. A portion of the participants was recruited through a standard undergraduate research pool and received partial course credit for their study involvement. For a more diverse sample, participants were also recruited using a campus-wide email recruitment message. Participants recruited in this manner received $10 in exchange for their involvement in the study. Our decision to only include females in the investigation was guided by theoretical principles identified in previous research on stereotype threat theory. Specifically, in this study, the stereotype threat context was centered on the common condition in the field of a perceived negative stereotype related to female math aptitude (Steele, 1997; Aronson et al., 1999). The experimental materials were completed in small groups ranging in size from 1 – 8 participants. Each data collection session took place in a private laboratory space equipped with desks and the computer software required to complete the experimental materials.

Experimental Manipulations

Self-affirmation induction. Participants in the study were randomly assigned to either a no self-affirmation condition or a self-affirmation condition. Participants in both conditions were first instructed to rank order a list of 10 characteristics and values in terms of personal importance (1 = *Most Important*, 10 = *Least Important*). The personal characteristics and values used in the self-affirmation induction were adapted from those appearing in prior self-affirmation studies. They included humor, creativeness, physical attractiveness, social skills, relations with friends and family, perseverance, good citizenship, sportsmanship, sensitivity, and solidarity (Martens et al., 2006; Sherman, Nelson, Steele, 2000).

Participants in the self-affirmation condition were then instructed to explain why their most valued characteristic is personally relevant and describe a time that the characteristic had been particularity important in their lives. Conversely, participants in the no self-affirmation

condition were instructed to explain why their least valued characteristic is essential to other people and describe when the identified characteristic was significant in another individual's life. The self-affirmation exercise was framed with an element of deception. Participants were told that the exercise was a supplemental component of the study designed to help researchers better understand undergraduate students' characteristics. This deception was employed because prior research suggesting value affirmation exercises' effectiveness is substantially reduced when participants are aware of their true purpose (Sherman et al., 2009).

Stereotype threat induction. Participants were randomly assigned to either a low stereotype threat or high stereotype threat condition. Consistent with prior research (Aronson et al., 1999), stereotype threat levels were manipulated through participants' instructions during the experimental procedure. All participants were informed that they were taking part in a research study designed to explore the factors influencing undergraduate student performance. Participants assigned to the high stereotype threat condition were informed that the experimental materials were highly diagnostic of mathematical ability. We decided upon this particular method of inducing stereotype threat because of meta-analytic work demonstrating that the use of indirect stereotype threat activating cues (such as emphasizing the diagnostic power of assessment materials) generate more substantial stereotype threat effects among female participants than methods that make explicit reference to the existence of negative societal stereotypes (Nguyen & Ryan, 2008). Consistent with past research, participants assigned to the low-threat condition were informed that the study was designed to pilot-test materials the researchers were developing for use in future studies. This manipulation was used in the control condition to ensure participants understood the investigation's purpose was not to evaluate their mathematical ability (Mertens et al., 2006).

Materials

Modular subtraction problems. In the current study, participants were asked to judge the accuracy of 30 high difficulty modular subtraction (MS) problems (see Beilock et al., 2007, for a detailed overview of modular subtraction problems). The MS problems were presented sequentially in the center of a computer monitor. They remained until participants reported on the accuracy of the equation (i.e., pressing the "t" key if the equation was correct and the "f" key if the equation was false). Modular subtraction problems are commonly used within stereotype threat research because the difficulty of modular subtraction problems can be easily manipulated by altering the complexity of the steps needed to solve each problem effectively. For instance, designing problems that require a borrow operation to solve increases the task's difficulty. Participants must utilize more attentional resources to hold and manipulate information needed to effectively solve the problems (Ashcroft, 1992; Beilock & Carr, 2005; Beilock et al., 2007). An index of mathematical performance was created by calculating the percentage of modular subtraction problems correctly answered during the experimental session.

Letter Memory Task. Intentional disengagement, or the ability to remove task-irrelevant information from attentional focus and replace it when necessary, was assessed using an adapted version of the letter-memory task (Miyake & Friedman, 2012; Morris & Jones, 1990; Rydell et al., 2014). During the study, participants completed 12 trials, during which lists of letters were presented sequentially. Each letter appeared in the center of a computer monitor for 2500ms. Consistent with prior research (Rydell et al., 2014), the 12 trials involved lists of differing

lengths (four 5-letter lists, four 7-letter lists, four 9-letter lists). Participants were instructed to maintain the last three letters presented in their working memory using a sub-vocal rehearsal strategy. Each trial concluded with a prompt to recall the previous three letters shown during that trial using a standard keyboard. An index of intentional disengagement was created by calculating the percentage of letter triads that were recalled correctly during the experimental session. The higher value indicated more remarkable intentional disengagement ability.

Operation Span Task. Intentional maintenance, or the ability to effectively allocate attentional resources to process task-relevant information in the face of interference**,** was assessed using an adapted version of the operation span task (adapted from Foster et al., 2015). During the operation span task, participants were shown a series of to-be-remembered letters presented sequentially. The length of the letter lists ranged from 3 to 8 unique letters. Each letter appeared in the center of a computer monitor for 750ms. Following each letter's presentation, participants engaged in a distractor task that involved judging a simple mathematical equation (e.g., $(7 \div 1) - 2 = 5$). Participants indicated each of the presented mathematical equations' accuracy by pressing the "t" or "f" key on a standard keyboard. Each mathematical equation appeared in the center of a computer monitor for a maximum of 8000ms or until participants reported the equation's accuracy. After each trial, participants were asked to recall the to-be-remembered letters in the order that they were presented by typing their responses into a textbox using a standard keyboard. Consistent with prior research, an index of working memory was calculated by calculating the percentage of letters recalled in the correct order during each trial – a reporting procedure known as the partial span (Foster et al., 2015).

Domain Identification. Prior research has identified domain identification as a key moderator of stereotype threat effects, with stereotype threat effects being most likely to occur among those who place considerable importance on performance within the stereotyped domain (Aronson et al., 2002). We assessed participants' domain identification levels using the domain identification scale (DIS; Lesko & Corpus, 2006). The domain identification scale is a 4-item measure designed to assess the importance of mathematical ability importance to participants' self-concept. Participants reported their agreement level with each statement using a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree). An index of the degree to which participants are math identified was created by averaging participants' responses to the four items. The responses were averaged such that higher values indicate stronger identification with the domain of mathematics. DIS's measure demonstrated acceptable internal consistency levels within the present study (Cronbach $\alpha = .83$, McDonald's $\omega = .84$).

Procedure

Each data collection session was randomly assigned to one of four experimental conditions: (1) low stereotype threat – self-affirmation, (2) low stereotype threat – no self-affirmation, (3) high stereotype threat – self-affirmation, and (4) high stereotype threat – no self-affirmation. At the onset of the data collection session, participants were told that the study's purpose was to understand better the factors influencing the undergraduate student's mathematical performance. Participants also provided informed consent. After informed consent, participants were immediately assigned a unique numeric identifier placed on experimental materials to ensure that participant data could be confidentially linked for data analyses. Participants then completed the following materials: (1) self-affirmation manipulation, (2) stereotype threat manipulation, (3) operation span task, (4) letter-memory task, (5) modular subtraction problems, (6) stereotype threat scale, (7) domain identification scale (8) self-integrity scale, and (9) demographic questionnaire. The presentation of the working memory tasks (i.e., operation span task & letter-memory task) were counterbalanced to avoid potential order effects. The stereotype threat manipulation, operation span task, letter-memory task, and modular arithmetic problems were programmed and presented using the E-Prime 3.0 software. (https:// www.pstnet.com; Psychology Software Tools Inc., Sharpsburg, Pennsylvania, USA). The self-affirmation manipulation was presented in a paper-and-pencil format, and Domain Identification Scale and demographic questionnaire were given using the Qualtrics online survey management system. After the data collection session, participants were debriefed and thanked for their time. The Ball State University Institutional Review Board approved the study materials and procedure.

Results

Descriptive statistics and bivariate correlations

Descriptive statistics and bivariate correlations among the primary variables of interest are presented in Table 1. As expected, correlational analyses indicated that intentional maintenance, intentional disengagement, and domain identification shared a positive relationship with participants' performance on the modular arithmetic problems. Further, our results revealed a significant positive correlation between scores on intentional maintenance and disengagement measures. Consistent with prior literature (Shipstead, Harrison, & Engle, 2016), this finding indicates that the two measures assess conceptually related but qualitatively distinct processes that contribute to executive attention and learners' problem-solving capabilities.

Analytic Plan

We decided to investigate the influence of the two experimental manipulations on the dependent variables using a 2 x 2 Multivariate Analysis of Covariance (MANCOVA). The dependent variables in the analysis were mathematical performance, intentional maintenance ability, and intentional disengagement ability. The analysis's independent variables were stereotype threat condition (low stereotype threat vs. high stereotype threat) and self-affirmation condition (i.e., no self-affirmation vs. self- affirmation). Consistent with stereotype threat research, domain identification was entered as a covariate in the analysis to control individual differences in the importance of the self-concept's mathematical ability (Steele, 1995; Aronson et al., 1999). Consistent with best practices, significant multivariate effects were explored using discriminant analysis (Tabachnick & Fidell, 2013).

Assumption Checks

Before performing our primary analysis, data were screened to satisfy the primary assumptions of MANCOVA. Our review of the collected data indicated no multivariate normality issues, homogeneity of variance-covariance matrices, or measurement points' independence. Additionally, data were screened for multivariate (i.e., Mahalanobis distance values that fell above a critical value on the x^2 distribution, df = 3, α = .001, critical value = 16.3) and univariate outliers (i.e., values falling outside Q1 – 1.5 x IQR and Q3 + 1.5 x IQR; Tukey's Boxplot method; Tukey, 1977). Using the criteria described above, we determine that our data contained no multivariate outliers. However, our review of the data revealed 19 participants who demonstrated unusual scores on one or more of the dependent variables. These cases were removed before the primary MANCOVA analysis. We believe our decision to remove outliers was justified given past research demonstrating that the presence of univariate and multivariate outliers can produce biased parameter estimates and contribute to faulty interferences about the relationship among constructs of interest when conducting MANOVA analyses (Orr et al., 1991; Todorov & Filzmoser, 2010; Tabachnick & Fidell, 2013).

MANCOVA Results

Our results revealed a non-significant multivariate main effect of stereotype threat (Wilk's λ = .99, F (3, 173) = 0.13, $p > .05$, η^2_p = .01) as well as a non-significant multivariate main effect of self-affirmation (Wilk's λ = .99, F (3, 173) = 0.32, $p > .05$, η^2_p = .01). Most notably, results of the MANCOVA indicated the presence of a significant multivariate interaction effect between stereotype threat and self-affirmation (Wilk's λ = .94, F (3, 173) = 3.25, $p < .05$, η^2_p = .06).

Post Hoc Comparisons

When significant multivariate effects are observed within MANOVA analyses, researchers must use posthoc comparisons to determine the specific nature of the group differences. Traditionally, researchers within psychological and educational domains have used univariate methods (i.e., univariate ANOVAs, Roy-Bargman Step Down Procedure, etc.) to investigate significant multivariate effects (Warne et al., 2012). However, experts in multivariate statistics have suggested that univariate techniques for posthoc comparisons are highly inappropriate. Specifically, univariate methods ignore the associations that exist among the outcomes of interest and often contribute to significant statistical power reductions and increased Type I error rates (Enders, 2003; Finch, 2007; Kieffer et al., 2001). Therefore, leaders in the field of multivariate analysis have suggested and repeatedly demonstrated that the most appropriate post hoc comparison for MANOVA techniques is the Discriminant Function Analysis (Sherry, 2006; Tabachnick & Fidell, 2013; Warne, 2014). Discriminant Function Analysis (DFA) is a multivariate technique designed to identify a linear combination of variables that contribute to group differences. Critically, DFA procedures produce values, known as discriminant loadings, that quantify the extent to which particular outcomes contribute to group differences. In the current examination, a variable was considered to meaningfully contribute to group differences if the associated discriminant loading value exceeded .30 (Tabachnick & Fidell, 2013). Examination of discriminant loadings revealed that the modular arithmetic problems' performance contributed to the significant interaction effect noted in the MANCOVA analysis. Interestingly, the DFA results indicated that intentional maintenance and disengagement ability

did not contribute to group differences in the significant multivariate interaction. Discriminant loadings are presented in Table 2.

Consistent with research in the psychological and educational domains (Mucherah & Frazer, 2013), we compared participants' average mathematical performance levels across the four experimental conditions to better understand the interaction effect's nature. A review of participants' mathematical performance revealed several interesting patterns. Contrary to our expectations, our results indicated that non-self-affirmed participants in the high stereotype threat condition demonstrated increased mathematical performance than non-self-affirmed participants in the low stereotype threat condition. This finding suggests that negative stereotypes' activation enhanced performance on the No Self-Affirmation condition's modular arithmetic task. Contrary to prior research, results of the current investigation indicated that engaging in the process of self-affirmation had a debilitative influence on math performance in stereotype threat-evoking situations. That is, self-affirmed participants exhibited reduced mathematical performance compared to non-affirmed participants when completing the experimental materials in a situation designed to induce stereotype threat (see Figure 1).

Discussion

The current study was designed to address a gap in the existing literature related to the facilitative influence of self-affirmation on executive attention components. More specifically, our study investigated if self-affirmation provides protective benefits to those confronted with stereotype threat by enhancing or restoring intentional maintenance and disengagement abilities, which are key features of executive attention. Following the first empirical demonstration of the debilitative influence of stereotype threat on the performance of stigmatized learners (Steele & Aronson, 1995), a sizable body of literature has demonstrated that the activation of negative societal stereotypes reduces performance on tasks associated with the stereotype (Lamont et al., 2015; Nguyen & Ryan, 2008; Spencer et al., 2016). Dominant theoretical frameworks have implicated information processing deficits following from maladaptive cognitive, affective, and behavioral responses to societal stereotypes as the primary mechanism through which stereotype threat undermines academic performance (Schmader & Johns, 2003; Schmader et al., 2008). Therefore, we expected that female participants exposed to stereotype threat-inducing cues would demonstrate reduced performance on a novel mathematical task and deficits in abilities that contribute to effective information processing (i.e., intentional maintenance & disengagement). However, our findings failed to support this general expectation, with high stereotype threat participants outperforming those assigned to a low-threat condition. Further, our data indicated that exposure to stereotype threat-inducing cues did not impact participants' intentional maintenance or disengagement capabilities.

Our findings are inconsistent with research demonstrating the debilitative influence of stereotype threat on stereotype-relevant tasks (Doyle & Voyer, 2016; Nguyen & Ryan, 2008; Spencer et al., 2016) and dominant theoretical explanations for stereotype threat effects focusing on the contribution of executive attention to performance difficulties (Schmader et al., 2008). However, we believe these findings are consistent with an alternative view emphasizing the importance of drive and prepotent responses in stereotype threat effects, a theoretical framework known in the literature as the "mere effort account" (Harkins, 2006; Jamieson & Harkins, 2007) or more recently the Threat-Induced Potentiation of Prepotent Response Model (TIPPR; Seitchik, Brown, & Harkins, 2017). The TIPPR proposes that the activation of negative stereotypes acts as a source of non-specific arousal for stigmatized learners (Jamieson &

Harkins, 2007). Prominent drive theorists have argued that arousal and subsequent drive states interact with habit strength to increase the emission of habitual response patterns (Cottrell, 1972; Hull, 1943; Zajonc, 1965; Zajonc et al., 1969). Supporters of the TIPPR have demonstrated that increased drive negatively impacts performance when habitual response patterns are *unlikely* to be correct – as is often the case on cognitively demanding tasks (Harkins, 2006; Jameson & Harkins, 2007; Spencer et al., 2016). However, a unique component of the TIPPR, and stereotype threat theory more broadly, is the belief that individuals confronted with stereotype threat are often highly motivated to disconfirm the negative stereotype (Steele & Aronson, 1995). As such, learners faced with stereotype threat have been shown to devote substantially more effort to task completion and increased cognitive resources to performance monitoring and performance correction than non-threatened individuals (Hutter et al., 2019; Seitchik et al. 2017; Steele & Aronson, 1995). Accordingly, empirical investigations have shown that individuals confronted with stereotype threat can exhibit performance that is on par or even superior to non-threatened individuals when task conditions allow them the opportunity to recognize and overcome prepotent response patterns (Jamieson & Harkins, 2007).

Our data fit with this interpretation of the motivational influence of stereotype threat and suggests the activation of negative stereotypes may have promoted increased self-regulation and approach tendencies among participants in the high-threat condition leading to increased mathematical performance. This alternative explanation's viability is increased when participants' mathematical performance is considered in conjunction with their performance on executive attention measures. That is, our inability to detect differences in constructs that are believed to be key mediators of stereotype threat effects (i.e., maintenance and disengagement) and the apparent facilitative influence of stereotype threat noted in this and other studies (i.e., Brown & Harkins, 2016; Jameson & Harkins, 2007) suggest theoretical orientations focusing solely on impairment in executive attention cannot fully account for stereotype threat effects (Pennington et al., 2019; Vohs et al., 2013).

Stereotype Threat, Self-Affirmation, & Mathematical Performance

The current study's primary focus was to address a gap in the literature related to our understanding of the causal mechanisms contributing to self-affirmations protective benefits among those confronted with stereotype threat. Specifically, we sought to replicate past findings noting the protective benefits of self-affirmation while investigating the impact of self-affirmation on mediators believed to underlie stereotype threat effects (Harris et al., 2016; Logel & Cohen, 2012). Our findings on engaging in a guided self-affirmation exercise were associated with reduced mathematical performance in the presence of stereotype threat-inducing cues was surprising given the sizable body of literature demonstrating that self-affirmation often exerts a protective influence on those confronted with stereotype threat (Mertens et al., 2006; Sherman et al., 2013; Tailandier-Schmitt et al., 2012). However, these findings are consistent with recent work that has that called into question the positive benefits of self-affirmation (Vohs, Park, & Schmeichel, 2012; Serra-Garcia et al., 2020). Wieland & Burnham, 2016).

For instance, in a series of four studies, Vohs, Park, and Schmeichel (2012) demonstrated that self-affirmation contributes to goal disengagement, characterized in their research by reductions in motivation, task effort, judgments of efficacy, and performance. Further, their investigation demonstrated that goal disengagement is most likely to occur among self-affirmed individuals when confronted with difficult tasks that contribute to failure experiences. Vohs and

colleagues reasoned that the experience of failure contributed to less favorable competence judgments and eventual goal disengagement because of evidence suggesting that individuals are more willing to attend to and process information that calls into question pre-existing beliefs or threatens perceptions of personal competence following self-affirmation (Harris et al., 2007; Sherman & Cohen, 2002; Sherman & Hartson, 2011). Therefore, it is possible that exposure to stereotype threat induced drive and facilitated prepotent responses in the current examination, increasing difficulty of the mathematical task. Further, we believe self-affirmation may have induced greater attention to stereotype threat related performance difficulties and failure experiences, thereby reducing perceptions of task competence and the desire to engage in the mathematical task.

Limitations

The current study contained limitations with the potential to influence the generalizability of the observed findings. First, data were collected primarily from undergraduate students who volunteered to participate in a standard undergraduate research pool. As a result, it is possible the results of the study may not generalize beyond the sample given the lack of variability observed in several demographic characteristics (i.e., age, ethnicity, etc.). Another limitation was our decision to rely on a single measure to assess intentional maintenance and disengagement. Although the use of single instruments is common in social and educational research, researchers often erroneously assume that measures of memory, executive functioning, and executive attention effectively isolate specific processes (i.e., are task pure; Jacoby, 1991). However, it is essential to note that the nature of the task(s) and characteristics of the performance situation lead participants to use various cognitive processes beyond the construct of interest to complete measures effectively (Friedman et al., 2008; Neath & Surprenant, 2005). As such, our measures of executive attention may have provided somewhat biased estimates of executive attention. One potential solution to the task purity problem involves using multiple measures designed to assess a single construct and scores on the separate measure to generate an overarching latent construct for data analysis (Friedman et al., 2008). Therefore, we believe future work in this domain must adopt a latent variable approach to provide a more accurate estimate of influence cognitive processes implicated in stereotype and self-affirmation effects.

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Table 1

Descriptive Statistics and Bivariate Correlations Among Operation Span Task, Letter Memory Task, Modular Arithmetic, and Domain Identification.

	1	2	3	4
1 - Operation Span Task	1	.34 *	.43 *	.18*
2 – Letter Memory Task		1	.29 *	.05
3 – Modular Arithmetic			1	.21 *
4 – Doman Identification				1
Mean (*SD*)	.62 (*.21*)	.73 (*.21*)	.76 (*.19*)	4.19 (*1.05*)

Note. * $p < .05$

Table 2

Summary of Results for the Discriminant Function Analysis

Variable	Discriminant Loading
Mathematical Performance	.87
Intentional Maintenance	.24
Intentional Disengagement	-.20

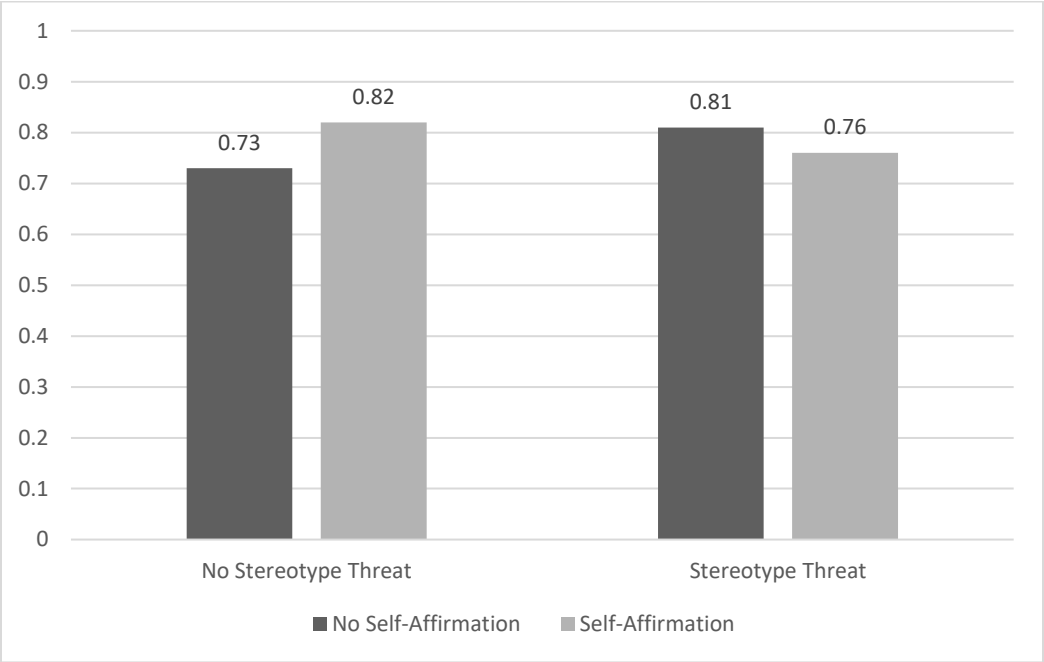

Figure 1

Average Performance on the Modular Arithmetic Items Across Experimental Conditions

Note: Domain identification was included as a covariate in the analysis