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Approaching math increases math = me and math = pleasant ☆

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Abstract

In two studies, we examined the effect of extensive practice in approaching math on implicit identification with math, implicit math attitudes, and behavior during a math test. The results from Study 1 demonstrated that women trained to approach math showed more identification with and positive implicit attitudes toward math than women trained to avoid math. Notably, this latter pattern of findings was only evident for women low in initial identification with this field. The results from Study 2 replicated these findings by showing that women who were initially low in math identification and trained to approach math showed more implicit identification with math and attempted more items on a math test than women trained to respond to math in a neutral way. The implications of these findings for current theorizing on the gender gap in women's representation in math related careers are discussed.

Keywords: Implicit attitudes; Implicit prejudice; Math identification; Gender gap; Approach behaviors; Stereotype threat

So my best guess, to provoke you, of what's behind all of this is that the largest phenomenon, by far, is the general clash between people's legitimate family desires and employers' current desire for high power and high intensity, that in the special case of science and engineering, there are issues of intrinsic aptitude, and particularly of variability of aptitude, and that those considerations are reinforced by what are in fact lesser factors involving socialization and continuing discrimination. Remarks by Lawrence H. Summers, President of Harvard University, January 14, 2005.

Gender disparity in the representation of men and women in fields related to mathematics, engineering, the physical sciences, and information technology persists (Cooper & Weaver, 2003; Crocker, Major, & Steele, 1998; Stangor & Sechrist, 1998). Women constitute only 11% of the engineering workforce (Tietjen, 2004) and 8% and 13% of tenured and tenure track positions in mathematics (Ripley, 2005) and chemistry departments (Marasco, 2005) at the top 50 research universities in the United States. This difference is unlikely to disappear in the near future; men are currently over four times more likely to choose a major that is high in math content than women (Betz, 1997; Tietjen, 2004).

In a recent conference focusing on the representation of women in math related fields within academia, then president of Harvard University, Lawrence Summers (2005), suggested two main causes for this gender gap. One reason was that women's ambitions differed from men's, with the implication being that women were not as committed to positions in science and mathematics. The second reason was that men and women differed in their intrinsic aptitude for science. Although President Summers acknowledged the possibility that socialization and discrimination could play a role in creating this disparity, he argued that these factors were less influential than gender differences in aptitude. In a subsequent critical review of the scientific data on sex differences in cognitive abilities, Spelke (2005) disagreed with Summers, concluding that "research on the

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cognitive abilities of males and females from birth to maturity does not support the claim that men have a greater intrinsic aptitude for mathematics and science'' (p. 956).

Rather than innate aptitude, Steele (1997) proposed that an important factor accounting for the different gender representation in mathematics is identification with the domain. Specifically, Steele suggested that many women have difficulty identifying with fields associated with mathematics because of inadequate support, few role models, and biased societal gender roles and stereotypes. He further argued that it is this *disidentification* with math that subsequently impedes many women's motivation, which leads to their underperformance and, ultimately, to their underrepresentation in math related fields (Davies, Spencer, Quinn, & Gerhardstein, 2002; Spencer, Steele, & Quinn, 1999; Steele, 1992, 2003; Steele, James, & Barnett, 2002). By focusing on a factor that can conceivably be changed, such as women's identification with math rather than on a factor that cannot be changed, such as innate ability, Steele and his colleagues provide a useful strategy to narrow the gender gap—modifying women's identification with math.

Social cognitive research suggests that one possible way to change women's identification with math is to have them ''approach'' math (Seibt & Förster, 2004). At a basic level, approach behaviors are often conceptualized as a frame of mind or motivation related to pulling something or someone toward one's body (Förster, 2001). Research in this area has provided consistent evidence that approach behaviors can influence attitudes toward mundane objects and social categories in a predictable fashion. People generally evaluate objects and categories more favorably following approach, as opposed to avoidance, actions (Cacioppo, Priester, & Berntson, 1993; Förster & Strack, 1997; Priester, Cacioppo, & Petty, 1996). For example, recent research by Kawakami, Phills, Steele, and Dovidio (2007) found that participants who were extensively trained to approach Blacks by pulling a joystick toward themselves were less prejudiced on an implicit attitude test than participants who were trained to avoid Blacks by pushing a joystick away.

In the present research, we extended these earlier findings by examining the impact of approach behaviors toward an academic domain. Whereas previous research has focused on nonsocial objects and social categories, we investigated whether approaching math concepts can influence attitudes toward that domain. Furthermore, the present studies also examined the novel idea that approaching math can influence associations between math and the self. Rather than limiting our examination of the effects of approach and avoidance to attitudes, two experiments explored the possibility that approaching a specific concept can impact people's identification with that concept. Because approach behaviors are related, both semantically and behaviorally, with bringing stimuli closer to the self, we predicted that training in approaching math by pulling this domain toward the self would increase association of this domain with the self, thereby increasing math identification (Greenwald & Farnham, 2000; Markham & Brendl, 2005; Nosek, Banaji, & Greenwald, 2002). Specifically, the present research employed a training procedure (Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000; Kawakami, Dovidio, & Van Kamp, 2005, 2007) to examine whether practice in approaching a specific academic domain such as math can influence women's implicit identification with math (Studies 1 and 2), their implicit attitudes toward math (Study 1), and their behavior during a challenging math test (Study 2).

Recent findings have demonstrated that individual differences in identification with mathematics can influence the effectiveness of various types of interventions and experiences related to stereotype threat. These studies have shown that women who are highly identified with math perform more poorly on a difficult math test when gender stereotypes are made salient because of fear of confirming these associations in a domain that is relevant and important to them (Aronson et al., 1999; Cooper & Weaver, 2003; Spencer et al., 1999). In contrast, because math is not as important to their self-concept, low identified women feel less pressure to disconfirm stereotypes in math related situations and therefore are not influenced by stereotype salience manipulations.

While recognizing the importance of studying stereotype threat effects for women highly identified with math, the primary focus of the present research was to examine the impact of an intervention aimed at strengthening the identification and improving the attitudes of women who are initially low in identification with math. Notwithstanding that the disidentification of this latter category may be due in part to stereotype threat processes experienced early on in life, strategies targeting this much larger group are critical to producing a society with a balanced representation of men and women in math.

Based on previous research demonstrating that training in responding in new ways to social categories (e.g., nonstereotypic associations with skinheads, approaching Blacks) positively impacts people's orientation to these categories (Kawakami et al., 2000, 2005; Kawakami, Phills, et al., 2007), we predicted that approach training would positively impact women who are low in math identification. Because this group has less experience approaching math, lower initial levels of identification with math, and more negative attitudes towards this domain than women who are high in identification, we predicted that approach training in comparison to control training conditions would increase the math identification of low identified women and improve their attitudes toward this domain.

Unlike women low in math identification, high math identified women have presumably had extensive experience in approaching math in high school and university math courses. We therefore expected that the training would have less of an impact on their responses in this domain (Kawakami et al., 2000, 2005; Kawakami, Phills, et al., 2007). Somewhat counter-intuitively, stereotype threat research even suggests that interventions designed to enhance the identification of group members who are weakly identified can undermine group members already highly identified with the domain. Aronson and his colleagues (1999) propose that strong external pressure to identify with a stereotype inconsistent domain can arouse stereotype threat and undermine the intrinsic association of people previously high in identification and thereby weaken the association of the self with the domain. Steele (1997) explains that "applying a strategy to school identified students (on the basis of their membership in a stereotype threatened group) that assumes weak identification, poor skills, and little confidence could backfire ... [and] increase stereotype threat and underperformance by signaling that their abilities are held under suspicion because of their group membership" (p. 624).

Based on this theorizing, we also examined the impact of approaching math on women who were already highly math identified. These women may be particularly vigilant to stereotypes, and so interventions that make stereotypes salient can induce stereotype threat (Davies et al., 2002; Spencer et al., 1999). Because women in general are associated with having difficulty in approaching and performing well in math, inconsistent behavior such as approaching math will be threatening to women who are highly math identified. Specifically, we expected that interventions that encourage approaching rather than avoiding or responding neutrally to math, would nullify or even impair any potentially positive effects of training on their identification with mathematics. In summary, although we did not expect any positive effects of extensive practice in approaching math with highly math identified women, we hypothesized that this training would improve how women who are initially low in math identification evaluate math, associate the self with math, and behave in math related activities.

Study 1

In Study 1, participants were preselected on the basis of their initial identification with math before being randomly assigned to an approach or avoidance math training condition. Following the training, all participants completed two Implicit Association Tests (IATs; Greenwald & Farnham, 2000; Nosek et al., 2002) related to math attitudes and identification with math. We chose to focus on implicit measures to avoid demand characteristics and other momentary motivations related to the training procedure and the experimental context which may affect overt controllable responses (Dovidio & Fazio, 1992; Nosek et al., 2002). Our primary hypothesis was that women who were initially low in math identification would show higher implicit identification with and more positive implicit attitudes toward math after training in approaching rather than avoiding math. Although the main target group in the present research was women low in math identification, we also predicted that women who were already highly identified with math would not be influenced by the training or would show even lower implicit identification with and more negative implicit attitudes toward math after training in approaching rather than avoiding math.

Method

Participants and procedure

Forty-four female undergraduates participated in the experiment for course credit. Prior to the commencement of the study, students were required to rate how much they liked math and how good they were at math on a seven-point scale either via email or in person to determine their identification with math.[1] Twenty women who circled four or higher on the scale to both questions (i.e., math identified) and 24 women who circled less than four on one of the questions (i.e., nonmath identified) were invited to participate in the study (Ben-Zeev, Fein, & Inzlicht, 2005; Spencer et al., 1999). Upon their arrival, these women were led to individual cubicles and informed that they would be involved in a series of separate studies. In reality, these students were randomly assigned to either an Approach or Avoid Math training task before being instructed to complete an attitude and identification IAT.

At the beginning of the *approach training task,* all participants were informed that they would be presented on a computer screen with images related to math and the arts and that the experimenter was investigating their responses to specific images to examine theories of cognitive processes. Participants in the Approach Math condition were instructed to approach math by pulling the joystick toward themselves (Chen & Bargh, 1999; Kawakami, Phills, et al., 2007) when presented with math symbols and to avoid the arts by pushing the joystick away from themselves when presented with arts symbols. In contrast, participants in the Avoid Math condition were instructed to avoid math by pushing the joystick away from themselves when presented with math symbols and to approach the arts by pulling the joystick toward themselves when presented with arts symbols.

On each trial of the training task, the photograph remained on the computer screen until the participant responded. If the response was correct, a blank screen appeared for 1000 ms before the presentation of the next photograph. If the response was incorrect, a blank screen appeared for 100 ms before a red "X" was presented for 800 ms followed by a blank screen for 100 ms before the next trial. In total, participants received 480 trials consisting of 10 blocks of 48 trials. In each block, 24 images related to math (e.g., calculators, equations) and 24 images related to the arts (e.g., guitars, poetry) were pre-

[1] Although 46 students participated in Study 1, the data from one student who did not follow instructions and one student whose mean responses were extreme outliers were excluded from the analyses.

sented in a random order. Participants were instructed to complete each trial as quickly and as accurately as possible. Before beginning the actual trials, participants were first presented with eight practice trials involving separate stimuli and after each block participants were given a short break.

The *Attitude IAT* was used to measure implicit attitudes toward math (Nosek et al., 2002). In this task, participants were instructed to categorize six words related to math (e.g., algebra, formula), the arts (e.g., music, arts), positive concepts (e.g., happy, rainbow), and negative concepts (e.g., vomit, hate). One set of critical trials instructed participants to press the same key when categorizing arts concepts and positive words and when categorizing math concepts and negative words. The other set of critical trials instructed participants to press the same key when categorizing math concepts and positive words and when categorizing arts concepts and negative words.

The *Identification IAT* was used next to measure implicit identification with math (Greenwald & Farnham, 2000; Nosek et al., 2002). The stimuli included in this task were different from the attitude IAT. In this task, participants were instructed to categorize four concepts related to math (e.g., calculus, equations), the arts (e.g., dance, literature), the self (e.g., me, myself), and others (e.g., they, other). One set of critical trials instructed participants to press the same key when categorizing arts concepts and self words and when categorizing math concepts and others words. The other set of critical trials instructed participants to press the same key when categorizing math concepts and self words and when categorizing arts concepts and others words. Each critical block in both the attitude and identification IATs consisted of 72 trials and the order of the critical blocks for both IATs was counterbalanced across participants.

Results and discussion

Attitude IAT

Before analyzing the data related to the attitude IAT, response latencies in which participants gave incorrect answers (6.2%) were excluded and cutoff latencies (as determined by the percentage of trials) were used to reduce outlier effects (Ratcliff, 1993). Specifically, response latencies that were less than 300 ms and more than 2000 ms (2.5%) were identified as outliers and recoded to 300 and 2000. Although all analyses were performed on logarithmically transformed data, for illustrative purposes the untransformed means are presented. The IAT effects were then computed by creating difference scores between the two critical blocks. Specifically, mean response latencies when arts concepts were paired with negative words and math concepts were paired with positive words were subtracted from latencies when arts concepts were paired with positive words and math concepts were paired with negative words

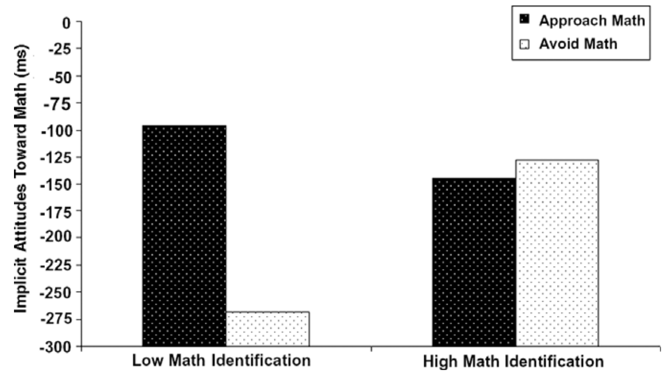

Fig. 1. Effects of approach training and initial math identification on women's implicit attitudes toward math.

(see Nosek et al., 2002). Higher scores reflected a more positive attitude toward math relative to the arts.[2]

To examine the effect of training on implicit attitudes toward math, a 2 (Training: Approach Math vs. Avoid Math) $\times$ 2 (Initial Math Identification: High vs. Low) ANOVA was performed on attitude IAT scores. A significant two-way interaction was found, $F(1,40) = 4.78$, $p = .04$, see Fig. 1. As predicted, low math identified women were faster to associate positive concepts with math after being trained to approach ($M = -96$ ms) than avoid ($M = -268$ ms) math, $t(22) = 2.81$, $p = .01$. In contrast, there was no difference in the speed of associating positive concepts with math between high math identified women trained to approach ($M = -144$ ms) and to avoid ($M = -128$ ms) math, $t(18) = .53$, $p = .60$.

Identification IAT

Before analyzing the data related to the attitude IAT, response latencies in which participants gave incorrect answers (5.0%) were excluded and latencies that were less than 300 ms and more than 2000 ms (1.2%) were recoded. Difference scores, based on logarithmically transformed data, between the two critical blocks were computed by

[2] Although analyses of the attitude and identification IAT data using an alternative scoring algorithm (Greenwald, Nosek, & Banaji, 2003; Nosek, Greenwald, & Banaji, 2005), which was tested with data collected online and in a less controlled environment and may be less sensitive to variations (including actual changes in implicit associations as a function of experimental manipulations), showed minor differences in significance levels in several analyses, the overall pattern of findings was similar. The analyses with the alternative algorithm produced a marginally significant two-way, Type of Training $\times$ Initial Math Identification interaction on the attitude IAT, $F(1,40) = 2.56$, $p = .11$. As expected, low identified women had more positive implicit attitudes toward math after being trained to approach ($D = -.26$) than avoid ($D = -.70$) math, $t(22) = 2.25$, $p = .03$. Attitudes for high math-identified women were the same after training in approaching and avoiding math (Ds $= -.36$), $t(18) = .001$, $p = 1.00$. In addition, the two-way interaction related to the identification IAT utilizing this alternative algorithm was significant, $F(1,40) = 8.61$, $p = .006$. Whereas low math-identified women were faster to associate the self with math after being trained to approach ($D = .06$) than avoid ($D = -.21$) math, $t(22) = 2.03$, $p = .05$, high math-identified women were slower to associate the self with math after approaching ($D = -.17$) than avoiding ($D = .12$) math, $t(18) = 2.15$, $p = .05$.

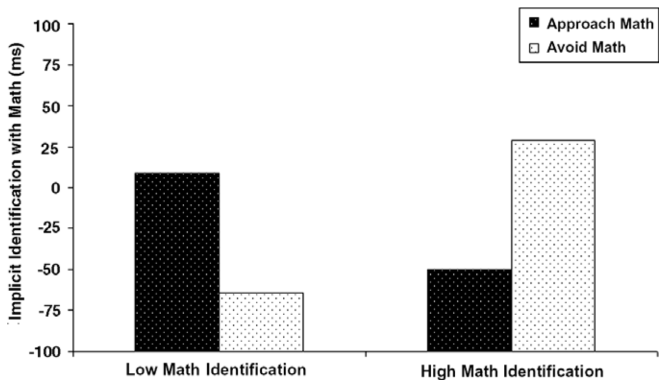

Fig. 2. Effects of approach training and initial math identification on women's implicit identification with math.

subtracting response latencies when arts concepts were paired with others and math concepts were paired with the self from latencies when arts concepts were paired with the self and math concepts were paired with others (see Nosek et al., 2002). Higher scores reflected greater identification with math relative to the arts.

To examine the effect of training on implicit identification with math, a 2 (Training: Approach Math vs. Avoid Math) × 2 (Initial Math Identification: High vs. Low) ANOVA was performed on identification IAT scores. As depicted in Fig. 2, a significant two-way interaction was found on the identification IAT, $F(1,40) = 8.09$, $p = .007$. As predicted, low math identified women tended to be faster in associating the self with math after training in approaching ($M = 9$ ms) than avoiding ($M = -64$ ms) math, $t(22) = 1.98$, $p = .06$. In contrast, high math identified women were slower to associate the self with math after approaching ($M = -50$) than avoiding ($M = 29$) math, $t(18) = 2.07$, $p = .05$.

As hypothesized, the results from Study 1 demonstrated that training women who were initially low in math identification to approach math improved their negative attitudes toward and implicit identification with math. This intervention was therefore successful in changing the associations of math with the self and with positive concepts for our main target group, low math identified women. Approach training, however, did not influence attitudes and adversely impacted identification for women who were initially highly math identified. These latter findings support theorizing related to stereotype threat processes which suggests that people already highly identified with a stereotype inconsistent domain may be vigilant to stereotype diagnostic situations and further reinforces the importance of "rendering onto the right students the right intervention" (Steele, 1997, p. 624).

Study 2

In accordance with the philosophy that strategies aimed at improving women's identification with math should be specific to the target group (Steele, 1997), Study 2 focused only on women who were not highly identified with math. A further goal of Study 2 was to extend the previous findings by examining the influence of approach behavior on math performance. In particular, after women were trained in Study 2 to either approach math or respond to math in a neutral way, they were presented with the identification IAT and a challenging math quiz. Based on recent findings by Davies et al. (2002) that measured women's motivation in math by the number of items they attempted, we expected that approach training would not only increase identification for low math identified women but would also increase the number of questions they attempted on a difficult math test.

Method

Participants and procedure

Fifty-six female undergraduates participated in the experiment for course credit or a movie pass.[3] Because we wanted to focus in this study on the large majority of women, we excluded only those students who were very highly identified with math. Specifically, all participants whose mean response was less than six on a nine-point scale designed to assess how pleasant they found five different math related activities (e.g., doing an algebra problem set, solving an equation, taking a calculus exam) were included in the study. Upon arrival, these participants were led to individual cubicles and were informed that they would be involved in a series of separate studies that were unrelated. In reality, after being initially randomly assigned to either an Approach Math or a Sideways Control training task, these participants completed an identification IAT followed by a math quiz.

Although the stimulus material and the procedure in the *Approach Math* training condition in Study 2 were the same as in Study 1, the control training condition differed. Rather than having participants avoid math and approach arts, participants in the control condition in Study 2 were presented with a more neutral task. Specifically, while half of the participants in the Sideways Control condition were instructed to push the joystick to the right when presented with math symbols and to the left when presented with arts symbols, the other half of the control participants were told to move the joystick to the left and right, respectively, when presented with math and arts symbols.

After completing the training, all participants were presented with the same *Identification IAT* used in Study 1. Each participant was subsequently presented with a difficult *math quiz* which consisted of 12 multiple choice math questions [e.g., If $f(\chi) = 4\chi^2 - 2\chi - 1$, then $f(1/2)$ equals (a) 1 (b) −1 (c) 0 (3) ½ or (3) 2]. Participants were instructed to answer as many questions correctly as possible within a 20 minute time frame (Shih, Pittinsky, & Amb-

[3] Although 58 students participated in Study 2, the data from two students who did not follow instructions were excluded from the analyses. An additional two participants did not complete the math quiz.

ady, 1999) and were allowed the use of paper for this task but not calculators.

Results and discussion

Identification IAT

Before analyzing the data related to the identification IAT, response latencies in which participants gave incorrect answers (4.7%) were excluded and outlier latencies that were less than 300 ms or more than 2000 ms (2.0%) were recoded. Difference scores of the logarithmically transformed data from the two critical blocks were computed with higher scores reflecting greater identification with math relative to the arts.[4]

To examine the effect of training in approaching math on implicit identification with math, a Training (Approach Math vs. Sideways Control) *t*-test was performed on the identification IAT scores. As predicted, women who were trained to approach math by pulling a joystick toward themselves were faster to associate the self with math ($M = 57$ ms) than women in a neutral control condition who were trained to push a joystick sideways to math symbols ($M = -22$ ms), $t(54) = 2.01$, $p = .05$.

Math quiz

To examine the effect of training in approaching math on participants' responses on the math quiz, a Training (Approach Math vs. Sideways Control) *t*-test was performed on the number of questions that the participants answered correctly and the number of questions that participants attempted (both correct and incorrect answers), separately. As expected, although approaching math did not increase the total number of correct answers, it did impact the number of questions attempted. Specifically, low math identified women in both the Approach Math ($M = 3.72$) and the Sideways Control ($M = 3.24$) conditions answered a similarly low number of questions correctly, $t(52) = .89$, $p = .38$. However, also as predicted, women who were trained to approach math attempted more questions ($M = 10.31$) than women who were trained to respond in a neutral way to math ($M = 8.72$), $t(52) = 2.12$, $p = .04$.

In summary, the results from Study 2 replicate the findings in Study 1 by demonstrating that training women who are low in initial math identification to systematically approach math can increase their implicit identification with this domain. Furthermore, the results also show that whereas training in approaching math did not influence these women's performance on a math test, it did increase the number of challenging math questions attempted.

[4] Analyses of the identification IAT using the alternative scoring algorithm (Greenwald et al., 2003) also demonstrated that women who were low in initial identification with math were faster to associate the self with math after being trained to approach math ($D = .17$) than after being trained to push a joystick sideways to math ($D = -.06$), $t(54) = 2.09$, $p = .04$.

General discussion

Many theorists have noted that the self-concept is a social entity—it changes according to the people and stimuli in its environment (Anderson & Chen, 2002; Kawakami et al., submitted for publication; Markus & Kunda, 1986). Recent research has demonstrated that the self can be measured at both an explicit and implicit level with implicit self-concepts reflecting the various types of information that we associate with the self in memory (Greenwald & Farnham, 2000). The primary goal of the present research was to examine whether extensive training in approaching math could influence associations between the self and math.

The results from two studies demonstrate that training women who are initially low in math identification to approach math can increase their implicit identification with this domain. Furthermore, the findings also show that this type of training can improve implicit attitudes toward math (Study 1) and increase the number of questions attempted on a difficult math test (Study 2). Not surprisingly, approach training did not immediately enhance overall math performance. Although this prospect needs to be examined in future research, it is conceivable that with sustained effort over an extended period, this strategy could ultimately lead to improved mathematical ability and motivation (Davies et al., 2002; Steele, 1997).

Together these findings have significant implications for decreasing the gender gap. If women's lack of participation in math related careers and majors at university is primarily due to factors such as identification with and attitudes toward this domain (Crocker et al., 1998; Halpern, Wai, & Saw, 2005; Steele, 1997), rather than intrinsic ability (Summers, 2005), the present research suggests that one way to address this issue may be to change the general avoidance orientation that many women have toward math. Our results suggest a direct way of modifying low identification with an academic domain is to provide women with extensive training in associating the self with math. These findings, however also suggest that other indirect ways of inducing women to "approach math" such as more female friendly teaching formats, positive female role models, segregated math classes for women, and the reduction of negative stereotypes related to women and math in the media and in our culture in general (Cooper & Weaver, 2003; Steele, 1997; Steele, Reisz, Williams, & Kawakami, 2007) may also be effective in changing math identification.

The present findings indicate that for the women in our study who were not strongly identified with math, a "wise strategy" to increase positive attitudes, positive identification, and more active participation is to approach math (Steele, 1997). However, this type of intervention appears to have an adverse effect for women who were already identified with math, presumably because the introduction of an intervention designed to make women "approach" math made the gender stereotype salient. Whereas in earlier research it seemed necessary to make skills assessments seem reliable and diagnostic and to make the participants' group identity salient to induce stereotype threat (Aronson et al., 1999; Steele, 1997), more recent research has demonstrated that simply making the stereotype salient is sufficient (Davies et al., 2002). Moreover, our research suggests that the specific way a stereotype is made salient is particularly critical for highly math identified women. Our research shows that for these women approaching math had adverse effects but avoiding math did not, even though both of these actions could conceivably make stereotypes salient. Future research might therefore productively examine the differential effects of various interventions that highlight behaviors that are inconsistent in comparison to consistent with the group stereotype. Whereas stereotype inconsistent behavior makes salient the group's inability to perform well in a domain and induces stereotype threat, stereotype consistent behavior mainly underlines the negative behaviors related to the group. It may not be the concern of confirming the stereotype that leads to stereotype threat but the pressure of disconfirming the stereotype.

Overall, our results suggest the exciting prospect that shifting women's orientation may be one key strategy to decrease the destructive consequences of the current gender gap in mathematics. As compared with a generation ago when many more men than women majored in biology, medicine, or economics, or a century ago when colleges were almost exclusively filled with men (Spelke, 2005), the findings from these two studies suggest the real possibility that the present disparity in math can also be eliminated.

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