



Motor Skill Learning in Iranian Girls: Effects of a Relatively Long Induction of Gender Stereotypes

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Abstract

The purpose of this investigation was to examine the effects of the relatively long induction of negative gender stereotypes on motor skill learning in young adolescent girls. Forty-six Iranian girls ($M_{age} = 14.02$ years old, $SD = 0.80$) were asked to practice a futsal kicking task (i.e., kicking a rolling ball toward a target) for 3 days with approximately 48 hours separating each session. Participants were randomly assigned to either a stereotype threat (ST) or nullified-stereotype threat (NS) group. Participants in the stereotype threat group randomly received related verbal, visual, and readable activation of gender stereotypes before each training session. The order of the manipulations (verbal induction on day 1 and so on) was randomly determined and this order was the same for all the participants. Two retention tests of 10 trials each, followed by two transfer tests, without feedback, were conducted 2 and 7 days later to assess the relatively permanent effects. Results showed that inducing negative stereotypes resulted in degraded kicking scores during the training sessions and degraded motor learning outlined by lower performance on the first and second retention and transfer tests. These findings provide the first evidence of the effect of relatively long induction of negative gender stereotypes on motor skill learning in adolescent girls.

Keywords Stereotype threat · Motor learning · Adolescents · Girls · Futsal · Stereotype induction · Motor skills · Athletics

Before 1928, women were not allowed to compete in track and field in Olympic events. The International Olympic Committee (IOC) claimed that endurance competitions were not suitable for women (for a review, see Gallucci, 2014). In the last two decades, these types of stereotypical beliefs and their effect on human performance, have been of interest

to many researchers. Negative stereotypes have frequently produced detrimental effects on individuals' performance in distinct domains. Based on the stereotype threat theory (Steele, 1997; Steele & Aronson, 1995), concerns that people experience due to being a member of a particular group, or their worries about proving (or disproving) stereotype beliefs related to the group to which they belong, may negatively affect their performance (Steele & Aronson, 1995). Of particular interest to the current research, researchers have reported impaired performances for women/girls assigned to a negative stereotype group in various motor tasks, including soccer-dribbling and kicking tasks (e.g., Chalabaev et al., 2008a; Grabow & Köhl, 2019; Hermann & Vollmeyer, 2016; Mousavi et al., 2021), basketball shooting and tennis serving tasks (e.g., Hively & El-Alayli, 2014; Laurin, 2013), a golf-putting task (e.g., Stone & McWhinnie, 2008) and a stride jumping task (e.g., Laurin, 2017).

For example, women who were reminded of a gender stereotype (i.e., female inferiority in soccer-playing abilities compared to men) demonstrated worst performances during a soccer-kicking task than those who were not reminded (Grabow & Köhl, 2019). Saemi et al. (2023) explored how explicit and implicit stereotypes influence girls standing

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long jump performance and their transient level of state anxiety. The study randomly assigned 204 girls to four different groups (i.e., explicit/implicit, explicit, implicit, and control groups). During the experimental phase, participants completed four trials of the standing long jump and the competitive state anxiety inventory. The study's findings indicated that children in the explicit/implicit and implicit groups performed worse in each trial during the experimental phase, suggesting that they were negatively affected by the stereotypes. Additionally, the explicit/implicit, explicit, and implicit groups reported higher levels of state anxiety than those in the control group.

Several possible mechanisms have been put forward to explain the performance decline in a stereotype threat situation, such as underperformance due to 1) explicit monitoring (i.e., a self-monitoring process to detect signs of failure), 2) extra pressure to succeed, 3) priming the stereotype (i.e., an ideomotor paradigm; stereotype-consistent behavior may automatically follow from the activation of a stereotype), and 4) threats to self-integrity and belonging (for a review, see Schmader et al., 2008; Spencer et al., 2016). The latter refers to the action individuals take to protect their self-worth, mainly described as self-handicapping. Self-handicapping may be exposed by failing to practice (Stone, 2002), reporting stress and other agents that could explain underperformance (Keller, 2002), or lowering their expectations for themselves (Cadinu et al., 2003), all of which could reduce the amount of effort individuals put forth.

To date, although numerous studies have investigated the effects of negative gender stereotypes on motor performance (for a review and meta-analysis, see Gentile et al., 2018), only a few studies have investigated the effect of gender stereotypes on motor learning (Cardozo et al., 2022; Cardozo et al., 2021; Heidrich & Chiviawowsky, 2015; Mousavi et al., 2021). Simply put, performance is observable behavior (e.g., if you observe a person hitting a baseball, you are observing a performance of the skill of hitting a ball). The impact of stereotype threat on motor performance can reveal how this activation affects *performance*, but it may not necessarily indicate how much *learning* has taken place (Magill & Anderson, 2020; Wulf et al., 2010). Motor learning can be defined as “a set of processes associated with practice or experience leading to relatively permanent changes in the capability for skilled movement” (Schmidt et al., 2018, p. 283). In other words, the person has increased his or her capability to perform a skill (Magill & Anderson, 2020). To observe the relatively permanent impact of a given independent variable and to distinguish motor performance from learning, the learners are provided a retention interval of sufficient duration (i.e., a rest time away from practicing the task) so that the transient effects of the experimental variable (i.e., the temporary/ephemeral effects of the independent variable on performance) will dissipate (Magill & Anderson,

2020; Schmidt et al., 2018; Wulf et al., 2010). That is, the stereotype threat can impact performance (i.e., only during the practice phase), learning of the task (i.e., performing after the rest period), or both.

However, it is not entirely clear which effect is the primary one. Some studies have recently examined whether negative stereotypes impair motor learning (Cardozo et al., 2022; Cardozo & Chiviawowsky, 2015; Cardozo et al., 2021; Chiviawowsky et al., 2018; Heidrich & Chiviawowsky, 2015; Mousavi et al., 2021), but to the best of our knowledge, only four of them focused on gender stereotypes (Cardozo et al., 2022; Cardozo et al., 2021; Heidrich & Chiviawowsky, 2015; Mousavi et al., 2021). For example, participants who were informed that dribbling a soccer ball involves athletic speed/power capacities and that women tend to perform worse than men showed degraded motor learning as compared to the participants assigned to the control group (Heidrich & Chiviawowsky, 2015). Recently, this effect was replicated among young adolescent girls during a soccer-shooting task (Mousavi et al., 2021). Interestingly, in that same study, the effect was no longer present three days after the stereotype manipulation. This result provided the first evidence of the non-sustainability of the negative stereotype effect on motor learning. However, the results were not entirely surprising due to the short-term induction of negative stereotypes.

Although it is not always the case, stereotype beliefs are internalized from a young age. In some cases, regardless of internalization, the fear of being evaluated based on the stereotype threat may impair performance (Steele, 1997). However, when stereotypes are internalized, the induction or activation of stereotypes could act as a “wake-up call” for the internalized stereotypical beliefs. Therefore, it is possible that performance decrement is directly related to the strength, duration, and type or form of the negative stereotype induction. In fact, individuals, particularly children and adolescents, encounter numerous stereotypical cues and information from various sources in their daily lives (Gill, 1992). For instance, social-cultural institutions such as family and school (Chalabaev et al., 2009; Duffy et al., 2001; Gill, 1992), and various sources (i.e., media, peers, and playgrounds) (Chalabaev et al., 2013; Knight & Giuliano, 2001) can provide information that shapes conventional attitudes and perceptions regarding gender roles. These different forms of potential stereotype cues provide the rationale for using diverse ways or forms of stereotype induction in related studies, such as verbal instructions, short clips, cards, and short newspapers. Regarding the duration of negative stereotype induction, it should be noted that environments and situations vary, with some being less threatening and some more threatening (Murphy & Taylor, 2011). Therefore, a girl or boy growing up in a stereotyped society may face more related cues daily from playgrounds to school and family members than those children in a

non-stereotyped society. However, the single stereotype manipulation used in most studies may not be realistic and may not fully capture how negative stereotypes influence individuals in stereotyped societies. In reality, individuals may be exposed to stereotypical information many times a week via diverse sources, including advertisements, newspapers, or conversations (Duffy et al., 2001; Gallucci, 2014; Gill, 1992). All these sources of stereotypical information have been shown to influence individuals' motor performance and learning (e.g., Cardozo et al., 2021; Chalabaev et al., 2008a, b; Hermann & Vollmeyer, 2016; Mousavi et al., 2021). To gain a more comprehensive ecological understanding of the stereotype threat effect and its endurance, it would be imperative to explore the impact of prolonged activation of gender stereotypes on performance and learning.

It is important to note that the present study was conducted in Iran, where gender stereotypes are deeply ingrained and girls may face cultural and religious barriers that restrict their ability to engage in physical activity in public (Mirsafian et al., 2014; Pfister, 2003). Conducting research on adolescent girls enhances the literature on the effects of stereotype threat, while also providing a valuable opportunity to replicate and extend previous work done on white Western girls and women. The decision to focus on this population is based on the fact that there are few studies examining the impact of stereotype threat in the motor domain specifically among adolescent girls (e.g., Laurin, 2013; 2017; Mousavi et al., 2021). This investigation is particularly important because there is evidence of a relationship between motor skills and academic performance (Cameron et al., 2016); thus, understanding this matter is imperative from both athletic and academic standpoints.

Therefore, the first objective of the present study was to create relatively realistic stereotype conditions through a repeated stereotype exposition to provide better insight into how the negative stereotype inductions would affect adolescent girls' motor performance and learning. Based on the stereotype threat theory proposed by Steele (1997), and previous studies that have examined the effect of gender stereotypes on motor skills performance (for a review and meta-analysis, see Gentile et al., 2018), we hypothesized that repeated exposure to negative gender stereotypes would impair the process of motor learning. (H_{general}). Specifically, we predict that inducing gender stereotype threats would hinder the skill performance of adolescent girls during the practice phase (H_1). Moreover, we hypothesize that the negative effects of exposure to gender stereotype threats would not be limited to the acquisition phase of motor learning. This implies that the harmful effects would not be transient and would persist for several days after the training sessions, possibly up to a week, and would have a relatively permanent impact on the skill performance of adolescent girls (H_2).

The second objective was to investigate the effects of stereotype threat on transfer ability – a significant indicator of learning. Transfer ability is essential for inferring motor learning and assessing the adaptability of motor performance changes related to motor learning. Transfer tests typically involve new tasks that have not been previously practiced or may entail new variations or conditions that were not practiced during the acquisition phase. For example, performing the task from a different distance, at a different speed, or under different lighting conditions (Schmidt et al., 2018; Wulf et al., 2010). In the present study, we employed the second application of the transfer test. Regarding the transfer test, our hypothesis (H_3) was that exposure to gender stereotype threats would have negative effects on transfer tests, meaning that these effects would transfer to other conditions of skill performance. Understanding the impact of stereotype threat on transfer tests is essential for gaining insights into how motor performance changes and adapts in the context of stereotype training conditions. This knowledge can help improve our understanding of the adaptability aspect of motor learning in stereotype training conditions.

Method

Participants

Forty-six Iranian adolescent girls who were right-dominant leg and novice futsal (i.e., indoor soccer) players aged between 13 and 15 ($M_{\text{age}} = 14.02$ years old, $SD = 0.80$) voluntarily participated in this study. All were naïve as to the specific purpose of the experiment. Moreover, none of them were routinely active in any specific sport. Informed consent forms were obtained from the parents/guardians and verbal informed consent was obtained from each participant. Approval of the study protocol was obtained from the ethics committee of the university. This study was conducted in Iran.

Apparatus and Task

Manipulation Check

To evaluate the effectiveness of the stereotype manipulations, participants were requested to rate the following two statements on a scale ranging from 1 (*totally disagree*) to 7 (*totally agree*): “Gender is an influential and determining factor in futsal” and “Boys/men are better futsal players than girls/women.” The first question was included to test whether gender affects the task from the participants' perspectives. The second question was included to test whether boys and men perform better on this task, as compared to girls/women from the adolescents' perspective.

Accuracy Task

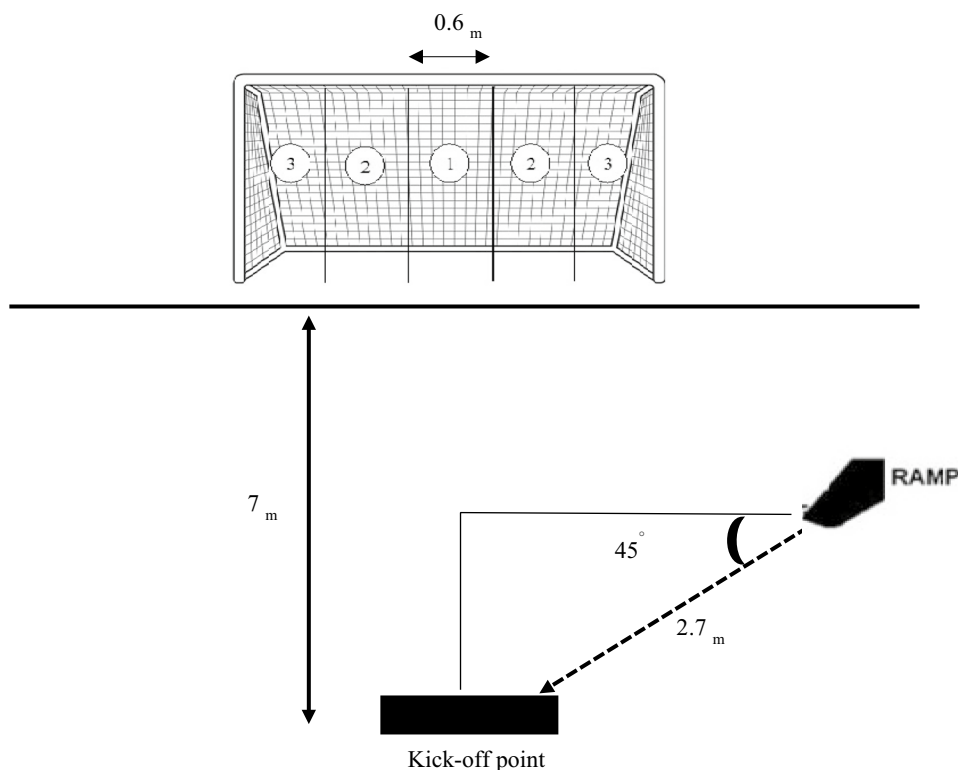
The task was based on futsal kick accuracy, and we asked the participants to kick a rolling ball. A ball kicked while rolling close to the ground is the most frequent type of kick in futsal (Barbieri et al., 2010). The task was based on "the kicking of a rolling ball" in Barbieri et al.'s (2010) study. The setups were modified and scaled for adolescent girls. The futsal goal (official size 3m × 2m) consisted of 5 zones (length: 0.6 meters; height: 2 meters) (see Fig. 1). To create identical conditions for all participants (velocity, direction, position of the ball), the ball was rolled down a small ramp (height: 40 cm; length: 70 cm). The ramp was placed at a 45° angle and 2.7 meters from the kick-off place. The distance between the goal and the kick-off point was 7 meters during the pretest, training sessions, and retention tests, and 8 meters during transfer tests. Participants were instructed to stand 2 meters behind the kick-off point and run to meet and kick the rolling ball when the ball crossed over the kick-off point. This task is relatively difficult and appropriate for stereotype threat studies not only because participants were novices, but also because a timing and agility/coordination requirement was imposed and they must manage their movement with the moving ball.

The participants were told to assume that the goalkeeper was standing in the middle of the goal and to get the highest score, they should try to kick in such a way that it hit as far away from the goalkeeper's hands as possible. The participants were informed that the balls that hit area number 3 will be awarded 3 points, while those hitting one of the other areas (areas number 2, and 1) will be awarded 2 or 1 point(s), respectively. A shot that missed the goal would earn 0 points. This modified task closely resembles the shots taken by futsal players during a game, and the task was approved by three futsal coaches.

Procedure

As previously mentioned, this study was carried out in Iran and therefore the instructions and manipulation check questionnaire were delivered in Persian. For the English translations provided in the text, the following procedure was used: (1) forward translation, (2) review of layout, grammar, and typography, (3) backward translation, and (4) review of all translations (forward, backward) by the original authors. The participants were first asked to perform 5 baseline trials. They were then divided into two groups: Stereotype Threat (ST) and Nullified-Stereotype (NS) groups. The participants were asked to practice a futsal kicking task (i.e., kicking a

Fig. 1 Schematic of the Experimental Set-Up



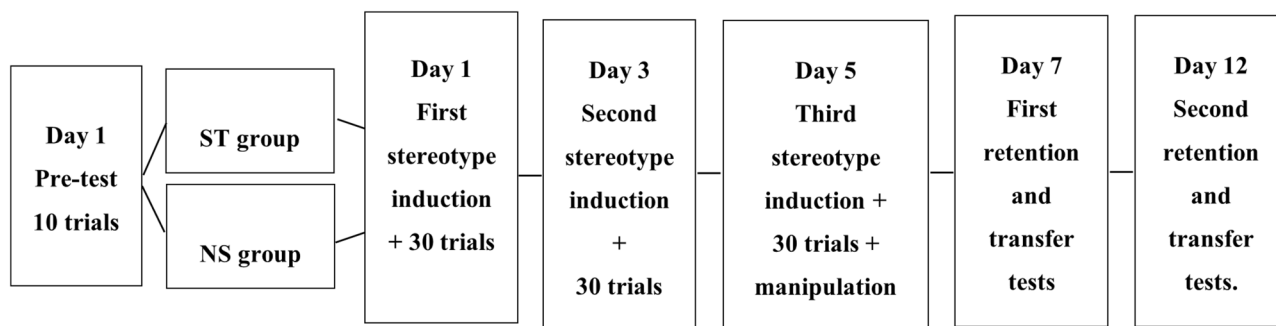


Fig. 2 Flow of Research Design and Protocol

rolling ball toward a target) for 3 days with approximately 48 hours separating each session. We used a relatively difficult futsal task to avoid ceiling and floor effects (Schmidt et al., 2018) and because stereotype-threat effects were most likely to be found on tasks that are pushing the upper limit of the individual's ability (Hively & El-Alayli, 2014; O'Brien & Crandall, 2003).

Before the first, second, and third sessions, the participants in the ST group received different forms of negative gender stereotypes. The rationale behind using different manipulation for each day was that individuals face different forms of stereotype cues from different sources such as family members, media, and school. Therefore, we used different forms of stereotype cues to create relatively realistic stereotype conditions to examine the overall effect of these manipulations and to increase the ecological validity of the manipulation, as much as possible. The order of the manipulations (verbal instruction on day 1 and so on) was randomly determined and this order was the same for all the participants.

Each practice day consisted of three blocks of 10 trials (i.e., 30 trials each day). In the first training session (first day, after the pre-test), the ST group participants received the following verbal instruction: *"You are going to perform a task of natural athletic ability that has been shown to produce gender differences; boys have been shown to perform better on this task."* Before the second session (approximately 48 hours later, third day), participants in the ST group received a card with the following text: *"Today, futsal is one of the fastest-growing indoor sports in the world. Futsal is designed to be a fast, furious, and skill-based game that also involves athletic speed/power capacities. Furthermore, some of the determinant physical capacities for successful performance in futsal are strength levels to kick, tackle, and repeat sprint ability. So, whoever wants to play futsal must be strong, furious, and fast. Moreover, the sport (Futsal) has long been dominated by men. This domination may be related to the involving capacities in futsal."* Before the third

session (approximately 48 h later, fifth day), participants in the ST group watched a video that lasts approximately 60 seconds, which contained several short clips of male futsal players making accurate kicks. The video was accompanied by additional information related to the observed content, as a sentence that highlights the superiority of men in futsal appeared on the screen at the end of the video (i.e., men/boys can kick better and with more accuracy).

For the NS group, before the first session, they were told that *"You are going to perform a task that involves agility/coordination capacities, where women normally perform similarly to men on this task."* Before the second session, participants in the NS group received a card with the following text: *"Today, futsal is one of the fastest-growing indoor sports in the world, this sport is played at the professional or amateur level by millions of players of either gender. Futsal is designed to be involving agility/coordination capacities, where women normally perform similarly to men. Indeed, this sport provides equal opportunities for men and women to progress and achieve high levels. Adherence to a proper training program and lifestyle can contribute to this progress."* Before the third session, participants in the NS group also watched a video that lasted approximately 60 seconds, which contained several short clips of male and female futsal players making accurate kicks. The video was accompanied by additional information related to the observed content (i.e., both men and women can make accurate shots).

At the end of the third session, all participants completed the manipulation check. Then, participants completed two retention tests of 10 trials each (i.e., performing the same task practiced in acquisitions sessions), followed by two transfer tests (i.e., kicking from 8 meters), without specific instruction, 2 and 7 days later to assess the relatively permanent effects (see Fig. 2). At the end of the study, participants were asked whether they practiced the skill at home between the practice sessions; all participants indicated that no practice was performed at home. Furthermore, the participants were debriefed after the study regarding its nature and purpose.

Table 1 Summary of Descriptive Statistics for Pre-test, Practice Sessions, Retention, and Transfer Tests

	Experimental Group	Pre-test	Practice S1	Practice S2	Practice S3	First Retention	Second Retention	First Transfer	Second Transfer
Mean	nullified stereotype (NS)	0.95	1.25	1.48	1.54	1.71	1.64	1.51	1.36
	stereotype threat (ST)	1.17	1.17	1.12	1.13	1.07	1.08	0.94	0.98
SD	nullified stereotype (NS)	0.47	0.36	0.26	0.33	0.37	0.33	0.35	0.33
	stereotype threat (ST)	0.53	0.30	0.23	0.25	0.42	0.39	0.44	0.48
Min	nullified stereotype (NS)	0.20	0.77	1.03	0.93	0.90	0.80	0.70	0.70
	stereotype threat (ST)	0.40	0.67	0.60	0.60	0.50	0.30	0.20	0.10
Max	nullified stereotype (NS)	2.00	1.90	2.00	1.97	2.30	2.20	2.40	2.10
	stereotype threat (ST)	2.00	1.97	1.47	1.67	1.80	1.80	1.80	1.50

$N = 46$

Results

Manipulation Check

The results of the stereotype manipulation check revealed that 20 participants in the ST group reported a score of 6 or 7 ($Q1: M = 6.52, SD = 0.73, \text{Median} = 7; Q2: M = 6.52, SD = 0.85, \text{Median} = 7$); while 15 participants of the NST group reported a score of 1 or 2 ($Q1: M = 2.00, SD = 1.13, \text{Median} = 2; Q2: M = 1.87, SD = 1.01, \text{Median} = 1$). For the first question, the Mann-Whitney U test showed that the ST group compared to the NS was more likely to believe the effect of gender on futsal (Mann-Whitney $U = 0.00, n_1 = n_2 = 23, p < .001$ two-tailed). For the second question, the Mann-Whitney U test showed that the ST group compared to the NST was more likely to believe that boys/men are better futsal players (Mann-Whitney $U = 0.05, n_1 = n_2 = 23, p < .001$ two-tailed).

Kicking Accuracy

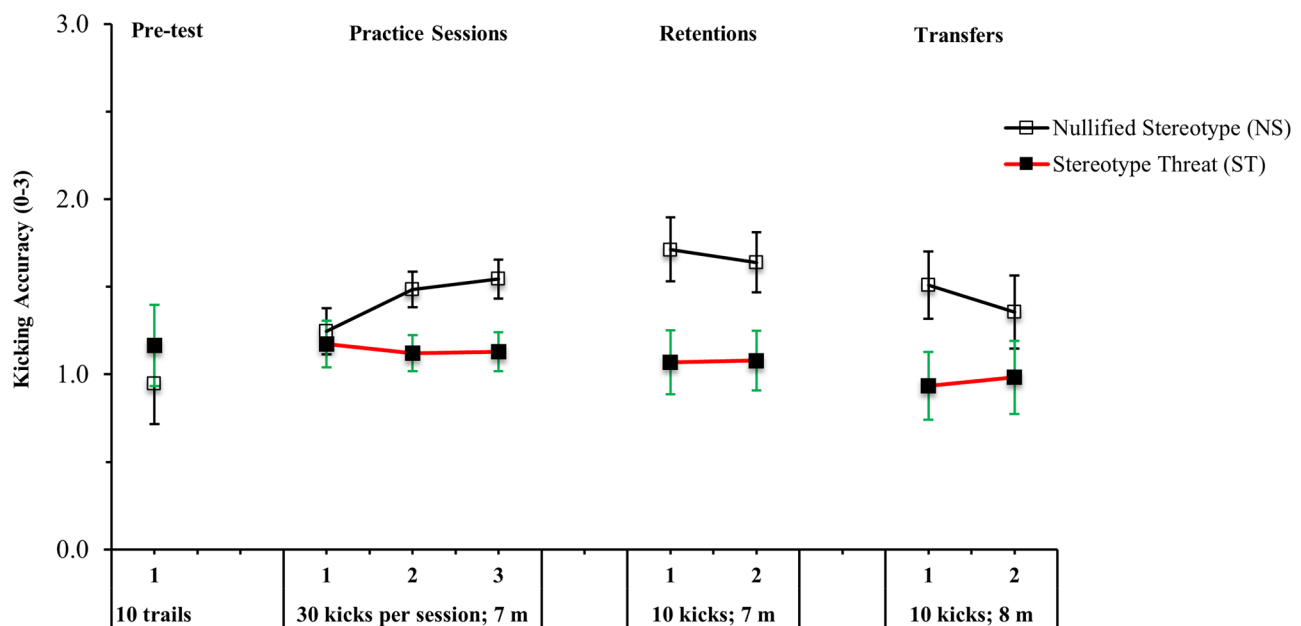
Pre-test

The kicking performance of the ST and NS groups on the pre-test, practice sessions, retention, and transfer are displayed in Table 1. An independent samples t -test was conducted to determine whether there was a difference in the baseline scores between the ST and NS groups. Cohen's d for t -test was used as an estimate of effect size. The evaluation of Cohen's d corresponded to a low ($d = 0.20$), medium ($d = 0.50$), and large ($d = 0.80$) effect (Cohen, 1988). The results revealed a non-significant difference between the groups on the pre-test, $t(44) = 1.47, p = .15, d = 0.43, \text{Mean} \pm SE \text{ difference} = 0.22 \pm 0.15$.

Practice Sessions

H_1 stated that inducing gender stereotype threats would hinder the skill performance of adolescent girls during the practice sessions. This hypothesis was tested by using a 2 (stereotype condition: ST vs. NS) \times 3 (practice session: 30 kicks per day) mixed model analysis of variance (ANOVA) with repeated measures on the last factor. We analyzed the trend changes of kicking scores on each ST and NS group by separate planned polynomial contrasts. Partial eta squared (η_p^2) was employed as an estimate of effect size in ANOVAs, where $\eta_p^2 = 0.01, 0.06$, and 0.14 were estimates for small, moderate, and large effect sizes, respectively (Cohen, 1988). The significance level for all statistical analyses was set at 0.05 . During the practice sessions, the NS group improved scores from the first to the third session, while the ST group did not improve. This was supported by the interaction effect, $F(2, 88) = 5.31, p = .007, \eta_p^2 = 0.11$, as well as the main effect of stereotype condition, $F(1, 44) = 25.44, p < .001, \eta_p^2 = 0.37$. The main effect of practice session was not significant, $F(2, 88) = 2.70, p = .073, \eta_p^2 = 0.06$. Thus, the NS group outperformed the ST group during the practice sessions.

We then conducted a more detailed analysis by comparing the two groups on each of the three separate practice sessions (i.e., S1, S2, and S3). Our findings showed no significant difference between the groups in S1, $t(44) = 0.74, p = .46, \text{Mean} \pm SE \text{ difference} = 0.07 \pm 0.09$, but significant differences between the groups in S2, $t(44) = 4.98, p = .0001, \text{Mean} \pm SE \text{ difference} = 0.36 \pm 0.07$, and S3, $t(44) = 4.79, p = .0001, \text{Mean} \pm SE \text{ difference} = 0.41 \pm 0.08$. In other words, the NS group outperformed the ST group in S2 and S3. Overall, our results confirmed our hypothesis (H_1). Planned polynomial contrasts for the NS group showed a significant linear effect, $F(1, 22) = 11.21, p = .003, \eta_p^2 =$



Note. The error bars represent 95% confidence intervals associated with each mean.

Fig. 3 Mean Kicking Accuracy of the Stereotype Threat Groups across Pre-Test, Practice Sessions, Retention and Transfer Tests

0.34, which indicated a positive linear increase from S1 to S3 for this group. The analysis for the ST group was not significant.

Retention and Transfer Tests

Our hypothesis (H_2) stated that exposure to gender stereotype threats would have a relatively lasting impact on motor performance during retention tests, indicating that the negative effects would persist over time. Additionally, H_3 predicted that exposure to gender stereotype threats would have negative effects on transfer tests. To test H_2 and H_3 , we analyzed the first and second retention and transfer tests were analyzed using separate 2 (stereotype condition: ST vs. NS) \times 2 (test time: first vs. second) ANOVAs with repeated measures on the last factor. Partial eta squared (η_p^2) was employed as an estimate of effect size in ANOVAs, where $\eta_p^2 = 0.01$, 0.06, and 0.14 were estimates for small, moderate, and large effect sizes, respectively (Cohen, 1988). The significance level for all statistical analyses was set at 0.05. The results for retention tests revealed a significant main effect of stereotype condition, $F(1, 44) = 57.54$, $p < .001$, $\eta_p^2 = 0.57$. The main effect of test time, $F(1, 44) = 0.17$, $p = .68$, as well as the interaction effect, $F(1, 44) = 0.28$, $p = .60$, were not significant. Based on these effects and the mean scores of the groups, the NS group outperformed the ST group in the first and second retention tests, indicating that our results confirmed our hypothesis (H_2).

The results of transfer tests revealed a significant main effect of stereotype condition, $F(1, 44) = 26.92$, $p < .001$, $\eta_p^2 = 0.38$. The main effect of test time, $F(1, 44) = 0.46$, $p = .50$, and the interaction effect, $F(1, 44) = 1.96$, $p = .20$, $\eta_p^2 = 0.04$, were not significant. Based on these effects and the mean scores of the groups, the NS group outperformed the ST group in the first and second transfer tests, indicating that our results confirmed our hypothesis (H_3). Mean kicking accuracy of the stereotype threat (ST) and nullified stereotype (NS) groups across pre-test, practice sessions (1-3), and retention and transfer tests are displayed in Fig. 3.

Discussion

The present study was designed to investigate the effect of relatively long induction of negative gender stereotypes on motor performance and learning in Iranian adolescent girls. To the best of our knowledge, this work is the first of its kind to illustrate motor performance and learning outcomes under repeated exposure to negative gender stereotypes. We predicted that (H_1) adolescent girls assigned to the ST group would underperform those in the NS group during the training sessions. The results confirmed our hypotheses, the induction of negative stereotypes resulted in degraded performance during training sessions. Moreover, the results demonstrated that the relatively long induction of negative stereotypes degraded motor learning, this was outlined by lower performance on the first and second retention and

transfer tests. Overall, our results confirmed our hypotheses (H_2 and H_3).

Inducing negative stereotypes resulted in degraded performance during training sessions and the first retention test. These findings are in line with most studies evaluating the effects of gender stereotypes on athletic performance (for a meta-analysis, see Gentile et al., 2018), and the studies that investigated the consequences of negative stereotypes effect in relatively short retention intervals (e.g., Cardozo et al., 2021; Heidrich & Chiviacowsky, 2015; Mousavi et al., 2021). For instance, Mousavi et al. (2021) examined the effects of explicit activation of gender stereotypes on soccer performance on the learning of adolescent girls. The results demonstrated that participants in the negative stereotype group performed worse during the training sessions and the first retention test than those in the nullified-stereotype group.

Interestingly, the present study showed that the stereotype threat group showed degraded performance during the second retention test (i.e., day 12), indicating inefficient learning. In Mousavi et al.'s work (2021), the participants who received short-term induction of negative gender stereotypes didn't exhibit impaired performance on Day 4 (i.e., 3 days after the stereotype manipulation). One of the main differences between the study from Mousavi et al. (2021) and the present one is the repeated exposure to negative gender stereotypes. Indeed, Mousavi et al. (2021) induced the negative stereotype once, while the present study induced the negative stereotype several times to create relatively realistic stereotype conditions. We could expect that the performance decrement resulting from negative stereotype induction has a direct relation with the strength, duration, and type or form of stereotype induction.

More importantly, the question arises as to how these results can be explained. Although we did not measure underlying mechanisms, previous findings provided a logical explanation. Evidence from previous studies suggests that there may be different, but related mechanisms affecting individuals in short- and long-term exposure to negative stereotypes. If we consider a continuum of exposure to negative gender stereotypes, in the early stages of this continuum (i.e., during the early ages of a person in a stereotyped society or in cases of short-term activation of stereotypes), individuals may adopt different coping strategies to deal with the negative stereotypes. During the early stages of exposure to negative gender stereotypes, individuals may experience pressure to succeed and be motivated to disconfirm negative stereotypes or avoid confirming them (for a review, see Spencer et al., 2016). For instance, this “pressure to succeed” can promote strategies and outcomes such as conscious attention to automatic processes (Beilock et al., 2006) and a self-monitoring process to detect signs of failure (Schmader et al., 2008).

With moving forward on this continuum (i.e., growing up in a stereotyped society, being exposed to negative stereotypes for a relatively long time), the performance of a targeted individual could probably be explained by learned helplessness (Pryce et al., 2012; Seligman, 1975). Learned helplessness refers to beliefs that one has little or no control over events in related domains. With helplessness, little or no effort is exerted to change or control events and situations that are truly controllable. In fact, learned helplessness is associated with a belief that current or/and future success is not contingent on effort or practice. Instead, the performance is affected and determined by more internal, stable, and global causes (Au et al., 2010; Mikulincer, 1986). The development of helplessness is associated with exposure to uncontrollable events or conditions with low experience of success (e.g., performing difficult tasks in the early stage of learning) and attributing the lack of control to stable and internal causes such as gender or age (Peterson et al., 1993). Moreover, the parent-child relationship and the responses of the parent and teachers are also important factors in the development of helplessness. It would be possible that growing up in a negative stereotype society would aid in the development of helplessness. From the motor behavior perspective, this might have resulted in non-progressive performance and impaired learning, similar to the outcome of the ST group in the present study.

Especially during the practice sessions, the pattern in the ST group could be explained by the main aspect of learned helplessness, which is cognitive exhaustion (Gallucci, 2014). This cognitive exhaustion can result in individuals having difficulty concentrating on challenges and producing solutions for solvable problems. They may lack the energy or interest to think carefully about challenges and develop creative solutions. Moreover, adaptive responses to failures are hindered by helplessness (Gallucci, 2014). Under this circumstance, individuals would likely adopt “safe” strategies to avoid or suppress the source of threat or failure. Similarly, previous studies have shown that in ST situations, individuals are tempted to adopt self-regulatory defensive strategies, such as prevention focus (Mousavi et al., 2021; Schmader et al., 2008; Seibt & Förster, 2004). In other words, individuals tend to adopt safe and secure strategies to avoid failure and strive for a relatively stable performance. This pattern was evident in the current study, particularly during the training sessions, where the ST group demonstrated a relatively stable performance instead of exhibiting improvement. However, it should be noted that there was no significant difference between the groups in the first session, which is consistent with previous research that did not show an immediate effect of ST (Chalabaev et al., 2008a, b). Based on this finding, it can be argued that single/short inducing

of gender stereotypes (Chalabaev et al., 2008a, b) or even age stereotypes (Chiviacowsky et al., 2018) may not have an immediate effect on motor performance. Although the non-significant effect immediately after induction has been attributed to "stereotype reactance" (Chalabaev et al., 2008a, b), future research is necessary to uncover the underlying processes in these stages.

One interesting mechanism reported in motor learning and stereotype studies is linked to learners' affective levels. It has been argued that stereotype threat can affect motor learning by degrading learners' positive affect. Studies have shown that stereotype threat inductions have a negative effect on positive affect levels (Cardozo et al., 2021), perceived competence, and self-efficacy (Cardozo et al., 2022; Cardozo & Chiviacowsky, 2015; Heidrich & Chiviacowsky, 2015). For instance, in Heidrich and Chiviacowsky's (2015) study, participants in the stereotype threat group reported lower self-efficacy after practice and on the second day prior to the retention test. Moreover, the authors argued that decreased attention and an increased self-monitoring process to detect signs of failure may explain why beginners experience degraded learning under stereotype threat (Heidrich & Chiviacowsky, 2015).

An important consideration when interpreting the results of this study is the nationality of the participants. In Iran, while the intensity of gender differentiation is declining in individuals' minds and social institutions (Rafatjah, 2012), cultural and religious barriers, such as limited chances of exercising in public, and traditional gender roles and conceptions attributed to women/girls, including housekeeping, obedience, and passivity, may limit Iranian girls/women's opportunities for physical activity (Mirsafian et al., 2014; Pfister, 2003). On the other hand, participation in physical and sports activities could play a significant role in motor skills performance and self-esteem (Ericsson & Karlsson, 2011). However, living in a stereotyped society with cultural and religious roles and restrictions could shape the mindsets of girls and women regarding gender roles and the traits attributed to each gender. In such conditions, it is likely that girls/women would be more susceptible to confirming stereotypical beliefs, thereby reducing their expectations for better performance, and may become satisfied with their performance (Cadinu et al., 2003). It should be noted that further research is needed to confirm or refute these initial findings among girls/women in Western societies.

Another objective of the present research was to investigate the effects of repeated stereotype inductions on transfer ability, which has not been explored in previous studies. The results demonstrated adolescent girls in the ST group performed worse than those in the NS group on both transfer tests. This finding suggests that training under stereotyped conditions may impede individuals' ability to adapt their skills to new situations. Given that the transfer test used in

this study involved modifying the distance to the target, and that a second application of the transfer test would involve performing new tasks that have not been previously practiced, further research is necessary to modify the task itself or alter the practice task to generalize these findings. Nonetheless, the adaptability of individuals is a crucial aspect of motor learning, as it suggests that individuals can transfer their acquired skills into diverse training environments and different competitions.

Limitations and Future Research Directions

Some limitations should be noted. First, due to COVID-19, we were unable to collect extra psychological and/or physiological data such as hypertension, interest, and perceived competence. Therefore, future studies are encouraged to measure similar variables to increase knowledge and better understand the underlying mechanisms of the conditions. Indeed, it has been suggested that the ongoing performance pressure of stereotype threat might have long-term consequences on individuals' well-being (Blascovich et al., 2001; Spencer et al., 2016). Second, we examined the overall effect of these inductions in the present study; therefore, it was difficult to determine the effect of each induction or compare them to find out which one was the most influential manipulation. Thirdly, the effect of stereotype threat on performance may be influenced by several possible factors such as the difficulty of the task, the nature of the task, participants' level of expertise, and individual differences (Cullen et al., 2006; Deshayes et al., 2019; Hively & El-Alayli, 2014; Laurin, 2017; O'Brien & Crandall, 2003). Therefore, further research in different tasks and practice contexts should be encouraged to examine whether the findings of the present study can be generalized.

Practice Implications

The present study's findings have practical implications as they highlight the negative impact of prolonged exposure to stereotype cues on motor skill learning and transfer ability. Longer exposure could act as an obstacle to progress and diminish the adaptability of the learner and this negative effect may be attached to the learner and be present in physical education classes, recreational sports, competitive sports, and even in areas unrelated to the source of threat. Indeed, based on the stereotype threat spill-over model (for a review, see Inzlicht et al., 2012), it is possible that threatened individuals experience short and/or long-term effects in areas unrelated to the source of threat (e.g., Beilock et al., 2007). Therefore, raising awareness about stereotypes on a large scale through educational classes in schools and universities, television programs, and social media is crucial in Iran and other countries with similar conditions. Such efforts

can help to reduce the pernicious effects of stereotype threat not only in sports but also in various other areas of life. Previous research has suggested various methods to mitigate the negative effect of stereotype threat, methods such as leading participants to perceive a lower level of threat (reconstrual interventions; e.g., Good et al., 2008; Johns et al., 2008), coping interventions (e.g., Johns et al., 2005; Logel et al., 2009), and creating identity-safe environments (e.g., Davies et al., 2005; Drury et al., 2011). Therefore, it would be worthwhile to investigate the effectiveness of these interventions in the learning environment to help girls and women to perform better and achieve their potential.

Conclusion

To illustrate a relatively clear picture of motor skill learning in stereotype threat conditions, this study was conducted to investigate the effects of relatively long induction of negative gender stereotypes on motor skill (i.e., kicking a rolling ball toward a target) learning in young adolescent girls. Results revealed that inducing negative gender stereotypes resulted in degraded kicking scores during the training sessions and degraded learning outlined by lower performance on the first and second retention and transfer tests. The findings highlight the importance of increasing awareness regarding gender stereotypes, moreover, encourage more investigation to find effective stereotype-against interventions in the learning environment to help girls/women to perform more effectively.

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Data Availability The datasets generated and/or analyzed during the current study are not publicly available due to concerns regarding confidentiality and data protection. However, the data supporting the findings of this study are available from the corresponding author, upon reasonable request.

Code Availability Not applicable.

Compliance with Ethical Standards

Ethics Approval and Consent to participate The study was approved by the Research Ethics Committee of the University of Isfahan. It should be noted that all procedures performed in the present study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Also, Informed consent forms were obtained from the parents/guardians and verbal informed consents were obtained from the participants.

Consent for Publication Authors have all rights to the data and full consent to publish this paper.

Conflicts of Interest The authors have no conflicts of interest related to this study.

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