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Gender stereotypes and motor performance: How explicit and implicit stereotypes influence girls standing long jump and anxiety

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A B S T R A C T

Objectives: Inducing a negative stereotype toward women usually leads to a decrease in women's motor performance. Given that most studies have focused on explicit stereotype induction among adults, the main aim of this study was to investigate the effects of explicit and implicit gender stereotypes on standing long jump performance in children. The second aim was to investigate the effects of these same manipulations on children's state anxiety.

Design: A mixed model design with within-between-subject was used with standing long jump performance and state anxiety as dependent variables.

Method: Two hundred and four children (*M*age = 10.95 years, *SD*age = 0.85) participated in this study and were randomly assigned, after baseline measurement, into four different groups (i.e., explicit/implicit vs. explicit vs. implicit vs. control). Specifically, participants performed 8 trials of standing long jump (4 trials during the baseline phase and 4 trials during the experimental phase). Children also completed the competitive state Anxiety Inventory at baseline as well as immediately after the trials.

Results: For motor performance, children in the explicit/implicit group and in the implicit group were negatively affected by the stereotype manipulation during all trials whereas participants in the explicit group were only negatively impacted during the last two trials. However, regarding state anxiety, children were negatively affected after both explicit only and implicit only manipulations and more significantly after explicit/implicit manipulation.

Conclusions: The present research showed that the explicit and implicit manipulations influenced motor performance differently, but that these two manipulations increased state anxiety in the same way. Moreover, the combination of the explicit and implicit inductions leads to a greater significant negative influence on state anxiety but not motor performance.

1. Introduction

For many years, the stereotype threat phenomenon has been an interesting topic for researchers in the field of social psychology (Schmader, Johns, & Forbes, 2008). Studies have shown that this phenomenon is very pervasive and has a negative impact on individuals' performances. Indeed, this detrimental impact has been examined in different populations as well as with different stereotypes (for reviews or meta-analyses, see Doyle & Voyer, 2016; Lamont, Swift, & Abrams, 2015; Smith & Martiny, 2018). Specifically, the gender stereotype appears as the most investigated (for a meta-analysis, see Koch, D'Mello, & Sackett, 2015). Specifically, men are believed to have higher levels of intellectual ability compared to women, such as genius (Storage, Charlesworth, Banaji, & Cimpian, 2020) as well as a higher ability to perform motor skills (Chalabaev, Sarrazin, & Fontayne, 2008).

The first studies evaluating the effects of gender stereotypes mainly examined cognitive functions and showed, as expected, a performance impairment after the induction of a negative stereotype (e.g., Inzlicht & Ben-Zeev, 2000; Spencer, Steele, & Quinn, 1999; for a meta-analysis, see Liu, Liu, Wang, & Zhang, 2021). Many researchers in sports psychology have also tested the applicability of this phenomenon to motor tasks such as soccer tasks (e.g., Cardozo, Cibeira, Rigo, & Chiviacowsky, 2021;

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Chalabaev, Sarrazin, Stone, & Cury, 2008; Grabow & Khül, 2019; Heidrich & Chiviacowsky, 2015; Mousavi, Gray, Beik, & Deshayes, 2021), balance tasks (Cardozo, Chalabaev, & Chiviacowsky, 2022; Chalabaev, Sarrazin, & Fontayne, 2008), tennis and basketball tasks (Hively & El-Alayli, 2014; Laurin, 2013), gaming task (Kaye & Pennington, 2016), endurance tasks (Deshayes, Clément-Guillotin, & Zory, 2019; Deshayes, Clément-Guillotin, Chorin, Guérin, & Zory, 2020) and strength tasks (Chalabaev, Sarrazin, Fontayne, Boiché, & Clément-Guillotin, 2013; Laurin, Renard-Moulard, & Cometti, 2020). Overall, most studies have observed a performance impairment after the induction of the negative stereotype (for a meta-analysis, see Gentile, Boca, & Giammusso, 2018). For example, Chalabaev, Sarrazin, and Fontayne (2008) showed that women under threat underperformed on a soccer-dribbling task compared to non-threatened women. However, some studies failed to observe this effect and even found sometimes that the induction of a negative stereotype toward women leads to better performances (e.g., Deshayes et al., 2019).

In the literature, to explore the effects of gender stereotypes on motor performance, most studies have used explicit stereotype induction (e.g., Deshayes et al., 2019, 2020; Heidrich & Chiviacowksy, 2015; for a review, see Chalabaev, Sarrazin, et al., 2013) suggesting that the stereotype is explicitly evoked by the experimenter. For example, Heidrich and Chiviacowsky (2015) used the instruction "women normally perform worse than men" (p. 43) before performing the task to induce the negative stereotype. However, some previous studies, mainly conducted in the cognitive domain, used implicit stereotype induction (e.g., Cardozo et al., 2021; Hausmann, 2014; Hess, Hinson, & Statham, 2004; Smith & White, 2002; Stone & McWhinnie, 2008). It has been reported that implicit stereotypes can be effective even when individuals are not consciously aware of them and it may cause a person to behave in ways that seem racist or sexist, depending on their desire (Pardal, Alger, & Latu, 2020). For example, in Stone and McWhinnie's (2008) study, the negative stereotype was induced implicitly by the presence of an examiner of the opposite sex and a performance impairment was shown (see also Cardozo et al., 2021).

Generally, the studies conducted revealed that both explicit and implicit manipulations can lead to impaired performances among threatened participants (e.g., Cardozo et al., 2021; Deshayes et al., 2019, 2020; Heidrich & Chiviacowsky, 2015; Stone & McWhinnie, 2008). However, we have little information about the potential differences between these two manipulations in the motor domain. To the best of our knowledge, only one study has compared these two types of manipulations during a motor task (Cardozo et al., 2021). Specifically, female participants practiced soccer kicks in the presence of a man (i.e., implicit manipulation group), or received instructions such as men are superior to women during a soccer-kicking task (i.e., explicit manipulation group), or had both explicit and implicit manipulations at the same time (i.e., explicit/implicit manipulation group). Results revealed that the explicit manipulation group and the implicit manipulation group underperformed in the same way as compared to participants in the control group. Interestingly, the explicit/implicit group showed a greater negative effect.

Furthermore, some studies conducted in the motor domain have observed the effects only on performance indicators, such as the time to complete a soccer-dribbling task (e.g., Cardozo et al., 2021; Heidrich & Chiviacowsky, 2015; Hively & El-Alayli, 2014). Some researchers however, have suggested that investigating only the performance indicator is insufficient (e.g., Huber, Brown, & Sternad, 2016), and that negative stereotypes may also impact variables referring more to how the task is performed (e.g., Chalabaev, Sarrazin, et al., 2013; Laurin et al., 2020) or psychological variables, even if the performance indicator is not impacted (e.g., Deshayes, Clément-Guillotin, et al., 2020; Laurin, 2017). For example, Laurin (2017) did not find any stereotype threat effect on girls' performance during a stride jumping task but observed a negative effect on perceived competence. A recent study showed that even if the induction of a negative stereotype did not impact performance of another stereotype group, it negatively impacted subjective age (Deshayes, Clément-Guillotin, et al., 2020). Suggesting that, studies in the motor domain should focus more on how psychological variables are influenced by stereotype threat.

One of the most investigated psychological variables in stereotype threat research is anxiety, but few studies were conducted in the motor domain and results are inconsistent (Pennington, Heim, Levy, & Larkin, 2016). Anxiety is an unpleasant feeling from an unknown origin (Wittchen & Hoyer, 2001) that can be associated with cognitive and physical symptoms (Alvares, Quintana, Hickie, & Guastella, 2016). Furthermore, studies have shown that both explicit (Delgado & Prieto, 2008; Spencer et al, 1999) and implicit (Albuquerque, Bittencourt, Coelho, & Silva, 2017; Osborne, 2001) manipulations of negative stereotypes can increase anxiety levels (for a review see Pennington et al., 2016). However, although some studies have emphasized the effect of anxiety on the relationship between stereotype threat and performance (Aronson et al., 1999; Keller & Dauenheimer, 2003; Laurin, 2013; Tempel & Neumann, 2014), some ambiguous results also emerged (Mayer & Hanges, 2003; Spencer et al., 1999; Steele & Aronson, 1995). Therefore, more research is needed in this area. In the motor domain, few studies have looked at the effect of anxiety on the relationship between stereotype threat and motor performance. For example, Laurin (2013) showed that somatic anxiety can affect the relationship between stereotype threat and motor performance, though in the case of cognitive anxiety this result was not reported (Laurin, 2013).

Finally, though the effects of stereotype threat have been widely investigated in adult women (for a meta-analysis, see Gentile et al., 2018), little is known about how negative stereotypes influence children and young adolescents (Mousavi et al., 2021). It is now established that awareness of stereotypes increases from the age of six to ten, and children become conscious of stereotypes around them and feel their effects in relation to themselves. For example, six-year-old girls are less likely, than boys, to believe that they are smart (Bian, Leslie, & Cimpian, 2017). Results showed that the concepts of gender and talent are formed in childhood and have an immediate effect on children's interests (Bian et al., 2017). Some research even states that children between the ages of five and eleven can easily examine stereotypes in society (McKown & Weinstein, 2003). They also develop other metacognitive abilities such as understanding the future, mental abilities, and concerns about evaluating others (Wellman, Cross, & Watson, 2001). For example, boys participate more in sports than girls and are more encouraged by their parents, while girls receive less support (Fredricks & Eccles, 2005).

These studies suggest that children may also be influenced by negative stereotypes (Bian et al., 2017; McKown & Weinstein, 2003; Mousavi et al., 2021). In line with this, some studies previously found, especially in the cognitive domain, that children can be impacted by the induction of negative stereotypes (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Désert, Préaux, & Jund, 2009; Hartley & Sutton, 2013). However, in the motor domain, only a few studies have been conducted in children (Mousavi et al., 2021; Rabeinia, Saemi, & Abedanzadeh, 2021). Among them, only the study by Mousavi et al. (2021) investigated the effect of the gender stereotype on girls' motor performances. Specifically, they showed that when a negative stereotype was induced, young girls assigned to the negative stereotype condition performed worse than girls in the control condition. However, more studies should be conducted in children to confirm or refute these first findings.

Moreover, although Cardozo et al. (2021) investigated the effects of explicit and implicit stereotype manipulations on adult women, no studies have investigated the effect of both explicit and implicit stereotypes in children and young adolescents during a motor task. Investigating the effect of both explicit and implicit stereotypes on children appears necessary because at school, there are male and female teachers (Berg & Lahelma, 2010), and if the results from Cardozo et al. (2021) are replicated in children, this would mean that girls may underperform at school in physical education classes when the teacher is a man, which can consequently have important modifications in their overall

academic success. Furthermore, Laurin (2013) has examined the motor performance and anxiety relationship in adolescents aged 14–16 years using an explicit stereotype manipulation. Given the possible differences between children's and adolescents' responses to stereotype threat interventions and the possible differences between the mechanisms influencing the two types of explicit and implicit manipulations in the motor domain (Pardal et al., 2020), it seems that more research is needed.

Accordingly, the aim of the present study was to examine the effect of implicit and explicit gender stereotypes on children's motor performance (i.e., using a standing long jump task) and anxiety. Based on the stereotype threat literature and recent research (e.g., Cardozo et al., 2021), we hypothesized that children's motor performance and anxiety would be degraded and increased respectively by the activation of both implicit and explicit gender stereotype threat each on alone. We also suggested that the combination of implicit and explicit manipulations would lead to a more significant effect (i.e., additive effect; see Cardozo et al., 2021).

2. Method

2.1. Participants

Participants were 204 female elementary students aged between 10 and 12 years (M_{age} = 10.95 years, SD_{age} = 0.85 years), recruited from local girls' elementary schools (i.e., 7 schools, 21 classes, approximately 10 children for each class) and volunteered to participate in the study during physical education (PE) lessons. The experiment was conducted in a quiet room for each participant. A sensitivity power analysis using Gpower 3.1 assuming an α of 0.05 and power of .80 indicated that our sample size would allow to detect small effects of ∯ 0.12, based on a within-between subject design.[1] To be included in the study, participants could not have any history of motor or cognitive impairment, needed to be novice in the task and aged 10–12 years old. However, they could not participate in this study if they were not motivated to continue participation or showed any sign of impairment that might affect their jump performance (i.e., exclusion criteria). All children's parents completed informed consent forms. The experiment was designed and conducted according to the Declaration of Helsinki and was approved by the University's Committee of Research Ethics (n°18111400).

2.2. Task and measures

2.2.1. Standing long jump

The task was a standing long jump, which was performed in an indoor hall. This task involved jumping with both feet forward and landing on both feet to reach the maximum jump distance. A strip was placed on the floor of the hall (20 mm) to mark the starting line for jumping. Participants' jump distance was measured using a tape measure. The distance, measured in centimeters from the starting line to the heel of the lander, was recorded and the mean score was used for statistical analyses. Importantly, participants received no information about their jump performances during testing.

2.2.2. Competitive state Anxiety Inventory - Form 2 (CSAI-2C)

The competitive state Anxiety Inventory - Form 2 for Children (CSAI-2C) is a multidimensional measure of competitive anxiety in sports adapted from Martens, Vealey, and Burton (1990; CSAI-2). It was designed to assess state anxiety levels in a competitive environment for children between 10 and 12 years (Stadulis, MacCracken, Eidson, & Severance, 2002). This questionnaire includes 15 questions, with three dimensions: Cognitive Anxiety (Worry- 5 items), Somatic Anxiety (Physical- 5 items), and Confidence (- 5 items) that are rated on a 4-point Likert scale from 1 (not at all) to 4 (very much so). Cronbach's alphas for each subscale were adequate at 0.74, 0.78 and 0.73 for cognitive anxiety, somatic anxiety, and confidence respectively. This questionnaire is a highly valid tool that has been used in most research in children (Munroe-Chandler, Hall, & Fishburne, 2008). The scores for all three subscales of state anxiety (cognitive anxiety, somatic anxiety, and confidence) were used for independent analysis.

2.2.3. Procedure

The present study used a within-between-subject design and consisted of two phases: a baseline measurement (T1) and an experimental measurement (T2). As soon as the children entered the hall, the criteria for participating in the research were reviewed and the eligible participants parents signed the consent form. Exercise guidelines were then implemented in accordance with the recommendations of the National Strength and Conditioning Association (NSCA). The warm-up phase included 3 min of low-intensity running as well as performing five two-legged on the spot jumps that were similar to the standing long jump, but with less intensity. After the warmup phase, participants were given 2 min of rest, during which the researcher explained the task and procedures of the research. In the baseline measurement, children were asked to perform a total of 4 jumps, without any special instruction and only in front of the main researcher who was a female (i.e., T1). The resting time between jumps was 30 s. Then, after a resting time of 2 min, each child was randomly assigned to one of the four conditions (i.e., T2). In the Control condition, participants did not receive any stereotype threat instruction and performed 4 jumps to their maximum power and with 30 s resting time between them in front of a female experimenter. In the explicit (E) condition, they received the following instruction before each of the 4 jumps: "the objective of this study is to compare boys' and girls' performances during a standing long jump. Previous studies have shown that girls have less strength and are weaker than boys and consequently, perform worse than boys on this type of task and we are trying to understand why" and performed to their maximum power in front of the female experimenter. In the implicit (I) condition, participants were told to perform a total of 4 jumps to their maximum power in front of a male experimenter. Then, in the explicit/implicit (E/I) condition, the participants were asked to perform a total of 4 jumps to their maximum power in front of the male experimenter and received the same instructions as participants in the explicit condition before each of the 4 jumps.

At the end of the eighth jump (i.e., after baseline measures and the condition measures), children completed the manipulation check questionnaire. They had to answer the following question: "Who do you believe performs better on this task?" with (1) referring to "boys perform better" and 7 "girls perform better ". Finally, the Competitive State Anxiety Inventory - Form 2 (CSAI-2C) was also completed by the children twice: one week before the start of the research (baseline measurement; see Deshayes, Clément-Guillotin, et al., 2020) and immediately after the end of the eight jumps.

2.3. Data analysis

To evaluate the effectiveness of the stereotype manipulation, a one-way analysis of variance (ANOVA) was used with Condition (E vs. I vs. E/I vs. C) as the only between-subject factor. Paired sample *t* tests were used for comparison within groups and Bonferroni correction was used to adjust for multiple comparisons.

For performance and anxiety, data were analyzed using a mixed model approach. Unlike traditional analyses of variance, mixed models have some advantages (Boisgontier & Cheval, 2016). For example, they consider the sampling variability of both participants and experimental conditions, reducing therefore the risk of Type 1 error; or prevent

[1] Parameters used for the sensitivity analysis: statistical test: analysis of variance, within-between interaction; α: 0.05; power: 0.80; number of groups: 4; number of measurements: 2; correlation among repeated measures: 0.5; nonsphericity correction E: 1.

information loss due to the averaging of measures, with the consideration of all single trials (Boisgontier & Cheval, 2016; Boisgontier et al., 2017). This statistical approach, more and more used and recommended, has especially been recently used to evaluate the effects of negative stereotypes on motor performance (Chalabaev, Palluel, & Ruchaud, 2020; Deshayes, Zory, Radel, & Clément-Guillotin, 2022).

Performance. In this study, performance referred to the distance of each jump. Rather than averaging the 4 trials, which results in a loss of information (Speelman & McGann, 2013), all measures were analyzed using a mixed msodel approach. The distribution was normal and consequently, a linear mixed model (LMM) was used. A random intercept effect structured by participants was included to control for the non-independence of the data. The fixed factors of the LMM were the performances at T1, Condition (E vs. I vs. E/I vs. C), the Trial (1 vs. 2 vs. 3 vs. 4), and the interaction between Condition and Trial. To account for the nested structure of the data (each measurement sample nested within a measure and each measure nested within a same individual), we included a random effect structured by participants and a random effect structured by measure by participants.

Anxiety. The distribution for each subscale of anxiety was positively skewed. To accommodate this skewed distribution of strength, a general linear mixed model (GLMM) was used by modelling strength data with a gamma function and a log link that is typically adapted for positive data that have asymmetry in the largest values (Myers & Montgomery, 1997). The fixed factors were the anxiety at T1, Condition (E vs. I vs. E/I vs. C), the Dimension of anxiety (Somatic anxiety vs. Cognitive anxiety vs. Confidence), and the interaction between Condition and Dimension of anxiety. To account for the nested structure of the data (each measurement sample nested within a measure and each measure nested within a same individual), we included a random effect structured by participants and a random effect structured by measure by participants.

3. Results

Manipulation check. The analysis of variance revealed a significant Condition main effect ($F(3, 200) = 26.77$, $p < .001$). Specifically, participants in the explicit/implicit group and in the explicit group reported that boys performed better on the task than girls ($M = 1.91$, $SD = 2.20$; $M = 3.69$, $SD = 2.67$ respectively) and, then participants in the control condition ($M = 6.18$, 2.09; $p < .001$). Finally, participants in the implicit group tended to report that boys performed better on the task than girls ($M = 4.88$; $SD = 2.90$) and, than participants in the control condition ($p = .055$). These results suggest that the stereotype manipulations were effective in order to induce a negative stereotype toward girls.

Performance. The LMM indicated a significant main effect of Condition ($F(3, 799) = 5.52$, $p = .001$), a significant main effect of Trial ($F(3, 799) = 5.74$, $p = .001$) but more importantly, a significant Condition × Trial interaction effect ($F(9, 799) = 2.86$, $p = .003$). Specifically, during the first trial, participants in the control condition performed better ($M = 106.76$; $SD = 16.86$) than participants in the explicit/implicit condition ($M = 99.86$; $SD = 19.52$; $p = .03$) and, than participants in the implicit condition ($M = 99.24$; $SD = 20.85$; $p = .03$). Interestingly, there was no significant difference between the control condition and the explicit condition ($M = 100.98$; $SD = 20.41$; $p = .30$). No significant difference was observed between the three experimental conditions (all $ps > .05$).

During the second trial, the same results were observed. Participants in the control condition performed better ($M = 105.59$; $SD = 18.04$) than participants in the explicit/implicit condition ($M = 98.67$; $SD = 19.59$; $p = .02$) and, than participants in the implicit condition ($M = 97.39$; $SD = 21.23$; $p = .01$). Interestingly, there was no significant difference between the control condition and the explicit condition ($M = 101.12$; $SD = 19.44$; $p = .17$). No significant difference was observed between the three experimental conditions (all $ps > .05$).

During Trial 3, participants in the control condition performed better ($M = 106.69$; $SD = 18.75$) than participants in the explicit/implicit condition ($M = 95.84$; $SD = 19.65$; $p < .001$), than participants in the implicit condition ($M = 98.27$; $SD = 22.01$; $p = .008$) and, than participants in the explicit condition ($M = 99.43$; $SD = 20.49$; $p = .03$). No significant difference was observed between the three experimental conditions (all $ps > .05$).

During Trial 4, participants in the control condition performed better ($M = 108.80$; $SD = 17.60$) than participants in the explicit/implicit condition ($M = 93.10$; $SD = 19.70$; $p < .001$), than participants in the implicit condition ($M = 97.02$; $SD = 22.22$; $p < .001$) and, than participants in the explicit condition ($M = 98.76$; $SD = 21.55$; $p = .001$). Finally, participants in the explicit/implicit condition performed worse than participants in the explicit condition ($p = .04$; Fig. 1 and Table 1).

Anxiety. The GLMM showed a significant main effect of Condition ($F(3, 599) = 43.33$, $p < .001$), a significant main effect of Dimension of anxiety ($F(2, 599) = 14.44$, $p < .001$) but more importantly, a significant Condition x Dimension of anxiety interaction effect ($F(6, 599) = 76.28$, $p < .001$). For somatic anxiety, results showed that control participants had lower somatic anxiety levels ($M = 1.13$; $SD = 0.29$) compared to participants in the explicit/implicit condition ($M = 2.33$; $SD = 0.55$; $p < .001$), participants in the implicit condition ($M = 1.72$; $SD = 0.38$; $p < .001$) and participants in the explicit condition ($M = 1.73$; $SD = 0.60$; $p < .001$). Interestingly, participants in the explicit/implicit condition had lower somatic anxiety levels than participants in the implicit and the explicit conditions (all $ps < .001$).

For cognitive anxiety, results showed that control participants had lower cognitive anxiety level ($M = 1.33$; $SD = 0.46$) than participants in the explicit/implicit condition ($M = 2.97$; $SD = 0.77$; $p < .001$), than participants in the implicit condition ($M = 1.87$; $SD = 0.52$; $p < .001$) and, than participants in the explicit condition ($M = 1.87$; $SD = 0.68$; $p < .001$). Interestingly, participants in the explicit/implicit condition had lower cognitive anxiety level compared to participants in the implicit and the explicit conditions (all $ps < .001$).

For confidence, results showed that control participants had higher confidence ($M = 3.37$; $SD = 0.68$) than participants in the explicit/implicit condition ($M = 1.88$; $SD = 0.59$; $p < .001$), than participants in the implicit condition ($M = 2.64$; $SD = 0.70$; $p < .001$) and, than participants in the explicit condition ($M = 2.77$; $SD = 0.81$; $p = .001$). Interestingly, participants in the explicit/implicit condition had lower confidence anxiety levels than participants in the implicit and the explicit conditions (all $ps < .001$; Fig. 2 and Table 2).

4. Discussion

The aim of the present study was to investigate the effects of explicit and implicit stereotype manipulations on children's standing long jump performance and anxiety. For the standing long jump performance, results revealed that participants in the implicit condition and in the explicit/implicit group performed worse during each trial as compared

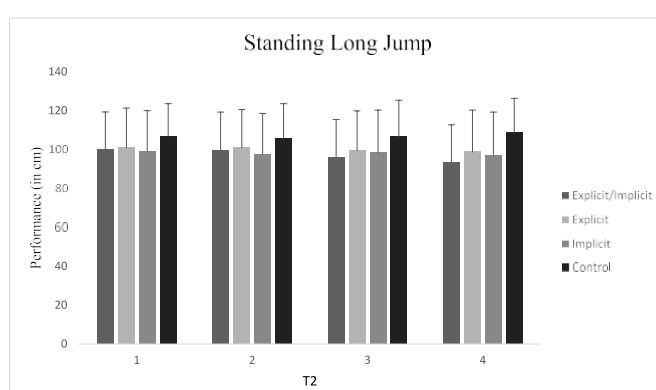

Fig. 1. Standing long jump performance for all experimental groups and trials at T2.

Table 1
Means (± standard deviations) for the standing long jump for each trial.

Groups							
Variables				Explicit/implicit group	Implicit group	Explicit group	Control group
Performance (in cm)	T1	Trial	1	105.49 ± 20.70	104.73 ± 20.05	99.55 ± 21.30	106.73 ± 18.49
		T2	2	104.37 ± 19.91	103.18 ± 18.43	103.47 ± 21.59	104.24 ± 16.18
			3	106.51 ± 19.89	105.18 ± 18.92	104.49 ± 20.64	106.25 ± 18.45
			4	106.86 ± 19.80	107.27 ± 20.21	105.04 ± 21.59	105.80 ± 17.57
	T2		1	99.86 ± 19.52	99.24 ± 20.85	100.98 ± 20.41	106.76 ± 16.86
			2	98.67 ± 19.59	97.39 ± 20.23	101.12 ± 19.44	105.59 ± 18.04
			3	95.84 ± 19.65	98.27 ± 20.01	99.43 ± 20.49	106.69 ± 18.75
			4	93.10 ± 19.70	97.02 ± 22.22	98.76 ± 21.55	108.80 ± 17.60

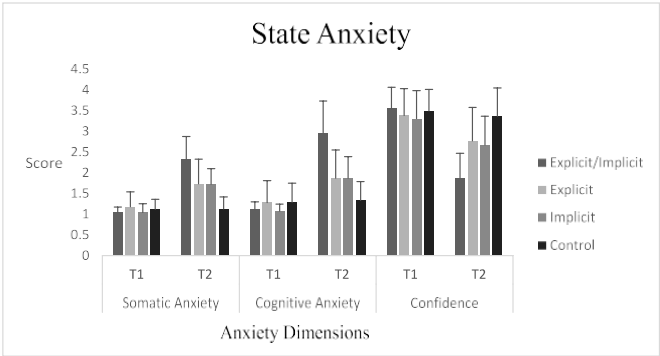

Fig. 2. State anxiety scores for all experimental groups and dimensions at T1 and T2.

Table 2
Means (± standard deviations) for the anxiety dimensions.

Groups						
Variables			Explicit/ implicit group	Implicit group	Explicit group	Control group
Anxiety	Somatic anxiety	T1	1.04 ± 0.13	1.04 ± 0.21	1.18 ± 0.36	1.12 ± 0.24
		T2	2.33 ± 0.55	1.72 ± 0.38	1.73 ± 0.60	1.13 ± 0.29
	Cognitive anxiety	T1	1.11 ± 0.19	1.07 ± 0.17	1.28 ± 0.53	1.29 ± 0.46
		T2	2.97 ± 0.77	1.87 ± 0.52	1.87 ± 0.68	1.33 ± 0.46
	Confidence	T1	3.56 ± 0.51	3.31 ± 0.68	3.39 ± 0.65	3.50 ± 0.52
		T2	1.88 ± 0.59	2.64 ± 0.70	2.77 ± 0.81	3.37 ± 0.68

to participants in the control group. Interestingly, participants assigned to the explicit condition performed worse than participants in the control group but only during the last two trials. Overall, these results are in line with previous studies (e.g., Cardozo et al., 2021; Mousavi et al., 2021) except for the absence of effect during the first two trials in the explicit group. However, for anxiety, results revealed that participants in the explicit group, in the implicit group and in the explicit/implicit group had a higher anxiety level than participants in the control group.

Firstly, no effect of the explicit stereotype manipulation emerged during the first two trials, whereas a performance impairment was observed during the last two trials. This result is interesting as it may suggest that the effects of inducting a negative explicit stereotype may not be immediate. This finding may not have been discovered earlier because most studies measuring the effect of explicit stereotypes, using several trials, averaged the trials to have a global performance measurement (e.g., Cardozo et al., 2021; Mousavi et al., 2021). Using the average, results in loss of information and consequently an impossibility to detect this absence of effect during the first trials, potentially explaining the absence of results observed in some previous studies (e.g., Chalabaev, Sarrazin, et al., 2013; Hively & El-Alayli, 2014). For example, Chalabaev, Brisswalter, et al. (2013) asked their participants to perform three maximal voluntary contractions. The maximal strength produced among these three trials was used as the main dependent variable and no significant differences were observed between the explicit negative stereotype group and the control group. It may therefore be possible that the maximal strength produced was performed during the first trials, explaining why no effect of the stereotype induction was observed. It could have been interesting to test the effect of this stereotype on the strength produced during each trial. More research is nonetheless needed to corroborate the findings of the present study. Indeed, some studies have observed an effect on only one trial (e.g., Hermann & Vollmeyer, 2016). For example, Hermann and Vollmeyer (2016) asked their participants to perform a soccer-dribbling task and observed a negative effect of the induction of the negative stereotype. The main difference between the study by Hermann and Vollmeyer (2016) and the present one could be the difficulty of the task. Indeed, they used a difficult soccer-dribbling task whereas the task in the present study seems to be an easy task (i.e., standing long jump). Some previous studies have suggested that the effects of stereotype threat would only emerge during difficult tasks (e.g., Hess, Emery, & Queen, 2009; Spencer et al., 1999; Steele, 1997). During less difficult tasks, threatened participants could not be impacted by the induction of a negative stereotype or may even increase their performance (e.g., Ben-Zeev, Fein, & Inzlicht, 2005; Neuville & Croizet, 2007; O'Brien & Crandall, 2003). With the result of the present study, it could be suggested that the effects of inducing a negative explicit stereotype during difficult tasks may appear instantly whereas a latent effect would be observed during less difficult tasks.

Secondly, conversely to the explicit condition, it can be noted that the implicit stereotype manipulation had a negative effect on the performance of each trial, suggesting that the simple presence of a male experimenter is enough to reduce girls' performances (see also Cardozo et al., 2021; Stone & McWhinnie, 2008). Few studies have examined the effect of implicit stereotype threat in the motor domain. In one study, Stone and McWhinnie (2008) reported that the accuracy of women's golf performance was impaired in the presence of a male examiner. These results were strengthened by the study of Cardozo et al. (2021). However, to the best of our knowledge, this research is the first to study this type of manipulation in children. The present study also showed that the combination of the explicit and implicit inductions had a negative effect on girls' motor performance. Moreover, during the fourth trial, the combination of explicit and implicit manipulations had a greater effect than the explicit induction, suggesting an additive effect of the explicit and the implicit induction which is consistent with previous research (Cardozo et al., 2021). Intriguingly, no significant difference was observed between the implicit group and the explicit/implicit group. These results could suggest that the explicit manipulation had a lower influence than the implicit manipulation.

Thirdly, results showed, for all subscales of state anxiety, an additive effect of the explicit and the implicit manipulations as well as their

individual effects. In the motor domain, little research has examined the effect of stereotype threat on psychological variables, including anxiety. However, in the cognitive domain research has shown that anxiety, as a psychological variable, can mediate the impact of stereotype threat on performance (for a review see Pennington et al., 2016). For example, Schmader and Beilock (2012) showed that individuals experience increased anxiety levels when stereotype threat is activated and that these increased anxiety levels can decrease a person's performance. Therefore, a possible mechanism involved in the performance decline under stereotype threat can be attributed to increased anxiety levels (Aronson et al., 1999; Spencer et al, 1999). The results of the present study revealed that children's state anxiety in both cognitive and somatic form increased in the presence of the explicit stereotype manipulation. This result is partially in line with previous research (Laurin, 2013). Indeed, this study showed that girl adolescents, who were exposed to an explicit stereotype, experienced a significant increase in their somatic anxiety levels but not their cognitive anxiety (Laurin, 2013). In addition, our results are inconsistent with Hermann and Vollmeyer's (2016) findings on the effect of stereotype threat on cognitive anxiety and worry. Their results showed that women were more negatively affected by the explicit activation of a stereotype threat condition compared to the control condition, but they did not observe a negative effect on cognitive anxiety. One possible reason for this discrepancy could be related to the tools used. For example, Hermann and Vollmeyer (2016) used the worry subscale of the Flow Short Scale (Rheinberg, Vollmeyer, & Engeser, 2003) while the current research used the Competitive State Anxiety Inventory - Form 2 (Stadulis et al, 2002). Another possible explanation could be the different populations used in the two studies (i.e., children vs adolescents). It is possible that the effect of stereotype threat on anxiety may be different according to the age of participants. Another part of the results of the current study revealed that during implicit stereotype threat induction, children experienced increased levels of anxiety. In other words, the girls experienced increased cognitive and somatic anxiety while practicing in front of a male examiner. Few studies have examined implicit stereotype threat in the motor domain (Cardozo et al., 2021), especially in children. Since implicit stereotype threat compared to, explicit activation also lead to a performance decline in children, therefore, it can be concluded that having girls practice sports in front of a male experimenter or teacher could have destructive effects on their motor performances by activating the gender stereotype threat, and by increasing levels of anxiety.

Our results also revealed that children's confidence, as the third subscale of state anxiety, decreased in the presence of stereotype threat manipulations. Cardozo et al. (2022) showed that men reported lower levels of satisfaction with performance, enjoyment, and overall perceived competence in explicit stereotype threat conditions. Chalabaev, Sarrazin, and Fontayne (2008) also showed that, although stereotype threat did not reduce participants' performance, it affected their self-confidence. These results are consistent with the results of the present study. Overall, our results showed that stereotype threat in any activation form can reduce performers' confidence levels, this decrease will be greater when stereotype threat is applied simultaneously explicitly and implicitly.

In addition to obtaining interesting results, the present research has practical applications. As evoked, girls underperformed when the test was administrated by a male experimenter. Consequently, it can be kept in mind that at school, during physical education evaluations, if the professor is a man, girls can potentially obtain worse results than expected; this can have deleterious effects on their global academic success. In addition, whether it be an explicit or implicit induction, a situation of threat generates high anxiety levels and poor confidence in children. Previous research has shown that state anxiety and confidence were closely related to academic success in children (Alfonso & Lonigan, 2021; Kleitman & Moscrop, 2010). Consequently, it seems essential to find a way to counter these negative implicit and explicit effects. In addition, one of the strengths of the present study was the use of a high sample size. Research on stereotype threat in the motor domain has mainly tested low sample sizes (e.g., Cardozo et al., 2021; Heidrich & Chiviacowsky, 2015; Mousavi et al., 2021), so the results of the present study can be discussed with greater confidence. Another strength was that the experimenters were blind to the aim and the hypothesis of the study, likely preventing any bias in the results. However, the present research has some limitations. Firstly, only girls were recruited. It can be interesting to observe, on some tasks, how implicit and explicit stereotypes may impact boys, which is currently unknown. Few studies have been conducted in men/boys but recent research revealed that inducing a negative stereotype toward men during a balance task negatively influenced men's perceived competence (Cardozo et al., 2022). Secondly, we explored how the presence of a male experimenter influenced girls' performance and anxiety, but only during one session. It could be wise to observe if the negative effect is permanent or attenuated over time. Thirdly, in this study, the explicit induction was verbally given. It could be interesting to see if the results obtained can be replicated with a non-verbal induction (e.g., stereotypical information given through a fictitious newspaper article; see Hermann & Vollmeyer, 2016). Finally, in the present study, the participants identification to the motor domain was not checked. Therefore, this seems to be a major limitation and should be addressed in future studies.

To conclude, results indicated that in children, an explicit stereotype manipulation had a negative effect on standing long jump performance but not immediately after the induction of the negative stereotype (i.e., performance decrease only observed during the last two trials). An implicit stereotype manipulation, however, had a direct effect on motor performance suggesting that implicit and explicit manipulations influenced children's motor performance differently. For state anxiety, both explicit and implicit manipulations had a negative effect, and their combination had a greater effect. These results suggest that future studies should always consider each trial when investigating the effect of negative stereotypes in the motor domain as well as psychological variables in order to have a complete view of how negative stereotypes impact individuals.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relations that could be construed as a potential conflict of interest.

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