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Understanding the impact of a teacher education course on attitudes towards gender equity in physical activity and sport: An exploratory mixed methods evaluation

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HIGHLIGHTS

- Study 1 investigated teachers' attitudes towards girls and physical activity.
- Study 2 explored more deeply, teachers' perceptions of the impact of the course.
- Preservice teachers reduced negative implicit and explicit attitudes towards girls.
- Teachers reported a new awareness and skills to address gender inequity.
- Teachers gained confidence to advocate for societal changes in gender equity.

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ABSTRACT

This study explored the impact of a university teacher education course on preservice and inservice teachers' attitudes towards gender equity in physical activity and sport. Preservice teachers ($n = 40$) completed an Implicit Association Test and explicit attitude measures pre- and post-course. Focus group interviews were conducted with preservice and inservice teachers ($n = 24$). Preservice teachers reduced their negative implicit and explicit attitudes towards girls and activity. Preservice and inservice teachers also improved their awareness and gained skills to address gender-related issues in schools. Targeted teacher education courses have the potential to improve gender equity in schools.

1. Introduction

The benefits of regular physical activity for children have been well documented, and span both physical and mental domains (Janssen & LeBlanc, 2010). However, 85% of girls aged 11–17 years are insufficiently physically active (Guthold, Stevens, Riley, & Bull, 2020). Internationally, few primary school-aged children (e.g., 5–13 years) are meeting their expected fundamental movement skill capacity (Eather, Bull, Young, Barnes, Pollock, & Morgan, 2018; Mitchell, McLennan, Latimer, Graham, Gilmore, & Rush, 2013; Mukherjee, Ting Jamie, & Fong, 2017; O'Brien, Belton, & Issartel, 2016). This is an issue, given that these skills are prerequisites for involvement in physical activity and sports (Lubans, Morgan, Cliff,

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Barnett, & Okely, 2010). Of note in these studies, is that overall, girls are less proficient than boys in object control skills. This information is consistent with data collected from Australian primary school-aged children 5–12 years, where only 16% and 18% of girls achieved advanced skill level in the kick and overarm throw respectively, compared to 54% and 52% in boys. Consequently, girls' physical activity levels (Dumith, Gigante, Domingues, & Kohl III, 2011) and participation in sport (Eime, Harvey, Charity, & Payne, 2016) dramatically decline during adolescence. Despite recent improvements in gender equality, traditional gender norms and stereotypes still negatively affect girls' physical activity experiences (Rauscher & Cooky, 2016; Spencer, Rehman, & Kirk, 2015). As such, strategies that aim to improve rates of physical inactivity and sport skill proficiency in girls, and address social constructions of gender require further attention.

1.1. Gender inequity in physical activity opportunities and participation

Gender disparities in physical activity also exist in schools, with girls less active than boys during physical education, and recess and lunch breaks (McKenzie, Marshall, Sallis, & Conway, 2000; Ridgers, Salmon, Parrish, Stanley, & Okely, 2012). Although schools are an important setting to improve girls' physical activity levels (Owen, Curry, Kerner, Newson, & Fairclough, 2017; Pearson, Braithwaite, & Biddle, 2015), studies have shown that girls face unique gender-related barriers to participating in physical activity and sport. Barriers include, pressure to conform to gender stereotypes (e.g., football is appropriate for boys, but not girls), dealing with consequences of challenging traditional gender roles (i.e., being labelled a "tomboy"), bullying by boys, self-consciousness in the presence of boys, perceived competency, restrictive school uniforms (Watson, Eliott, & Mehta, 2015), and less opportunities to play sport in the playground (Dudley, Cotton, Peralta, & Winslade, 2018).

Schools have been described as key settings for promoting gender equal environments (Spencer et al., 2015). Teachers influence children's construction of gender through classroom practices, expectations, language and attitudes (Younger & Warrington, 2008). Teachers also influence their students unknowingly through the 'hidden curriculum'. The hidden curriculum can be defined as the unplanned or unrecognized values and norms of an institution, that may be unintentionally taught to students (Jung, Ressler, & Linder, 2018). For example, teachers' beliefs and dispositions can affect the school culture, what is deemed acceptable or unacceptable behavior, curriculum offerings and teachers' language (Jung et al., 2018). Although teachers are expected to provide an inclusive environment for all students, teachers' attitudes and beliefs tend to reinforce negative gender stereotypes rather than challenge them (Esen, 2013). This suggests that teachers' attitudes and beliefs are not immune to society's powerful traditional gender norms, which can lead to the conscious and subconscious spread of gender stereotypes (Parri & Ceciliani, 2019).

Of concern is that teachers often treat male and female students differently, especially in physical activity and sport contexts. For example, teachers' use of gendered language is unfortunately common (e.g., calling out statements such as "stop kicking like a girl") (Valley & Graber, 2017), which sends powerful gender biased messages. Also, boys tend to dominate the choice of games during physical education classes, and teachers tend to select rules and equipment that favor highly skilled boys (Fisette, 2013). These behaviors send implicit messages that girls' voices and perspectives are not a concern for teachers. These implicit biases may partially explain why existing school-based interventions have had limited impact on girls' physical activity (Owen et al., 2017).

One potential reason for teachers' unequal treatment of male and female students may be their lack of awareness regarding their own biases (Esen, 2013; Valley & Graber, 2017). Research has shown that, in many cases, teachers' negative behaviors towards girls are unintentional (M. Sadker & Sadker, 1994). This lack of awareness is a problem, as there is evidence suggesting that teachers' attitudes and beliefs influence teachers' expectations of their students (Gunderson, Ramirez, Levine, & Beilock, 2012). Notably, teacher expectations have been linked to students' attitudes towards a subject, student performance, and long-term occupational choices (Gunderson et al., 2012; Tiedemann, 2000). Therefore, failing to address teachers' gender biased attitudes may unintentionally harm girls' performance and future ambitions in physical activity and sport.

1.2. Teachers' implicit and explicit attitudes

Teachers' biases can be either explicit or implicit. Explicit attitudes are conscious and deliberately thought out. Although these attitudes are commonly self-reported and studied, they are subject to social desirability biases (Greenwald, McGhee, & Schwartz, 1998; Nosek, Banaji, & Greenwald, 2002). Therefore, results may not be completely accurate if participants feel it is inappropriate to have negative biases. In comparison, implicit attitude measures draw on a person's subconscious awareness. The Implicit Association Test (IAT) measures automatic mental associations between members of a group (e.g., race bias: white/black, good/bad) (Greenwald et al., 1998). Capturing attitudes outside of the conscious awareness using the IAT is important as results may be more immune to self-presentation and social desirability influences (Greenwald et al., 1998).

Cross-sectional studies have examined preservice and/or inservice teachers' implicit and explicit attitudes towards weight status (Lynagh, Cliff, & Morgan, 2015), inclusive education (i.e., special needs children) (Lautenbach & Antoniewicz, 2018), and gender in Science, Technology, Engineering, Maths (STEM) (de Kraker-Pauw, van Wesel, Verwijmeren, Denessen, & Krabbendam, 2016). Although there has been increasing interest in reducing implicit biases, a recent systematic review found that many real-world interventions designed to reduce implicit prejudice and stereotypes have had little effect. Notably, only one of the 47 included studies targeted gender bias (men/leader versus women/supporter) (FitzGerald, Martin, Berner, & Hurst, 2019). The lack of research on implicit attitudes relating to gender and physical activity is a concern given the extensive research that has established physical education as a heavily gendered subject that favours masculinity and traditional masculine characteristics (Metcalfe, 2018; Wright, 1996).

1.3. Gender equity training for teachers

Gender equity training may be an important strategy to minimize gender biased teaching (Valley & Graber, 2017). Over the last few decades, researchers have tested the effects of gender equity training on principals (M. Sadker & Sadker, 1986), inservice teachers (D. Sadker & Sadker, 1985), Personal Development, Health, and Physical Education teachers (Wright, 1999), and preservice teachers (Erden, 2009; Wellhousen & Yin, 1997). For example, Wright (1999) designed a professional development workshop that educated teachers on the social construction of gender in physical education. During the workshop, teachers discussed potential practices that could reinforce narrow notions of masculinity and femininity and their consequences, and brainstormed specific strategies to address gender-related issues. Although post workshop evaluations were positive in relation to the information delivered and teachers'

understanding of the social constructions of gender, there was less certainty that the workshop had provided teachers with strategies to address gender-related issues.

Many teachers are not well trained in equitable teaching practices when they enter the profession (Erden, 2009), suggesting that there is a lack of courses that address gender equity (Esen, 2013). Although it is essential for inservice teachers to understand the importance of promoting gender equity through their teaching, educating preservice teachers on gender equity has been identified as a more viable alternative than a one off professional meeting (FitzGerald et al., 2019). Despite the importance of addressing gender inequity in physical activity and sport in schools, there is still a lack of recent evidence on the impact of gender equity training on teachers' implicit and explicit attitudes. Further, in a recent review of the literature from the past 10 years on gender equity in physical education, Parri and Ceciliani (2019) concluded that, gender issues in education require further attention.

1.4. Research aims of the present study

The first aim of this study was to explore the impact of a teacher education course on preservice teachers' implicit and explicit attitudes towards gender equity in physical activity and sport (Study 1). We hypothesized that: (i) preservice teachers would have negative implicit and explicit biases towards girls in relation to physical activity and coordination, and (ii) the teacher education course would improve these negative biases. Moreover, Study 2 set out to explore in greater detail, the impact and effectiveness of the course in relation to pre-existing negative biases using qualitative methods, to understand teachers' experiences of the course, as well as themes related to gender equity and girls' participation in physical activity.

All components of Study 1 and Study 2 were approved by the Human Research Ethics Committee at the University of Newcastle [H-2014-0330].

2. Study 1

2.1. Methods of study 1

2.1.1. Study design and participants

Study 1 used a single group, pre-post design. Preservice teachers were eligible to participate in this study if they had enrolled in an elective teacher education course (EDUC4017) in Semester 2, 2017 and Semester 2, 2018 at the University of Newcastle. A total of 40 preservice teachers (17 = 2017; 23 = 2018) were invited during an introduction lecture to participate in the study. Participants were either enrolled in an undergraduate Bachelor of secondary teaching (Health and physical education) or Bachelor of primary teaching degree program. All preservice teachers returned consent. See Fig. 1 for additional detail on the participant flow of preservice teachers and Fig. 2 for a procedural timeline. Note, inservice teachers are included in the figure as they were invited to attend the 3-day training workshop, which was the major component of the course. Additional information related to inservice teachers is included in Study 2.

2.1.2. The teacher education course

The elective teacher education course, EDUC4017: 'The Daughters and Dads program: Optimising children's physical activity and well-being' trained preservice teachers to deliver the novel 'Dads And Daughters Exercising and Empowered' (DADEE) physical activity program in the local community. It was advertised as a teacher education course that allowed students to be part of a research-based project designed for fathers and their primary school-aged daughters. Promotion focused on the program's aim to improve girls' physical activity, sport skills and social-emotional well-being.

The DADEE program is a world-first father-daughter physical activity intervention, targeting fathers to improve their daughters' physical activity levels, sport skills and social-emotional well-being (Morgan et al., 2019; Young et al., 2019). Fathers are taught positive parenting strategies and become gender equity advocates, who empower their daughters to resist the pervasive culture of gender prejudice that limits opportunities in all aspects of their lives. See elsewhere for additional information on intervention components (Morgan et al., 2019; Young et al., 2019). The DADEE program was tested in a pilot randomized controlled trial (RCT), where intervention fathers and daughters significantly increased their physical activity levels post-intervention, daughters improved their social-emotional well-being, grew closer to their fathers, and improved their fundamental movement skills (Morgan et al., 2019; Young et al., 2019).

Teacher Education Course Components. EDUC4017 included four components: an introduction lecture (2 h), a 3-day training workshop, field-based work and two assessment tasks.

Introductory Lecture. Preservice teachers attended a 2 h lecture in July. Attendees received detailed information on course requirements. Baseline assessments were conducted at the start of the lecture.

Training Workshop. The core component of EDUC4017 was a 3-day training workshop (15 h). In addition to preservice teachers, inservice teachers were also invited to this component of the course to be trained as DADEE program facilitators (see Fig. 1). Inservice teachers were recruited from local primary and secondary schools through school newsletters and via email to attend the 3-day training workshop component of EDUC4017. They were able to log 15 h of accredited professional development hours at the proficient teacher level from the state education standards authority. On completion of the workshop, a number of preservice and inservice teachers were chosen as program facilitators to deliver the 9-week DADEE program in the local community (2017: $n = 12$; 2018: $n = 15$).

During this workshop, preservice and inservice teachers learnt about the rationale of the DADEE program and program session content including: evidence-based strategies to increase physical activity levels, sport skill proficiency, and social-emotional well-being of primary school-aged girls; key parenting strategies and; innovative techniques for fathers to engage in one-on-one co-physical activity with their daughter. Attendees also learnt about how to deliver safe, engaging, and effective practical sessions focusing on rough and tumble play, fundamental movement skills and fitness-based activities. Importantly, teachers learnt how to identify gender inequity (e.g., referred to in the program as wearing your 'gender glasses' (Mackoff, 1996)), the potential risks of gender stereotyping, and strategies to counteract gender prejudice in school in relation to physical activity and sport.

Field-Based Work. In EDUC4017, preservice teachers were required to attend a minimum of two sessions at one of four DADEE programs over 9-weeks delivered in local primary schools from October to December. At the program, preservice teachers were asked to help with program logistics (e.g., equipment and room set up, greeting families, and marking the attendance roll), and interact and observe families.

Course assessment tasks. Preservice teachers were required to complete two assessment tasks as part of the course. First, they kept an observational diary during their teaching practicum that focused on their experiences of gender in physical activity and sport (e.g., physical education, sport, lunch time play, in-class activities). Preservice teachers then wrote a critical reflection on one issue

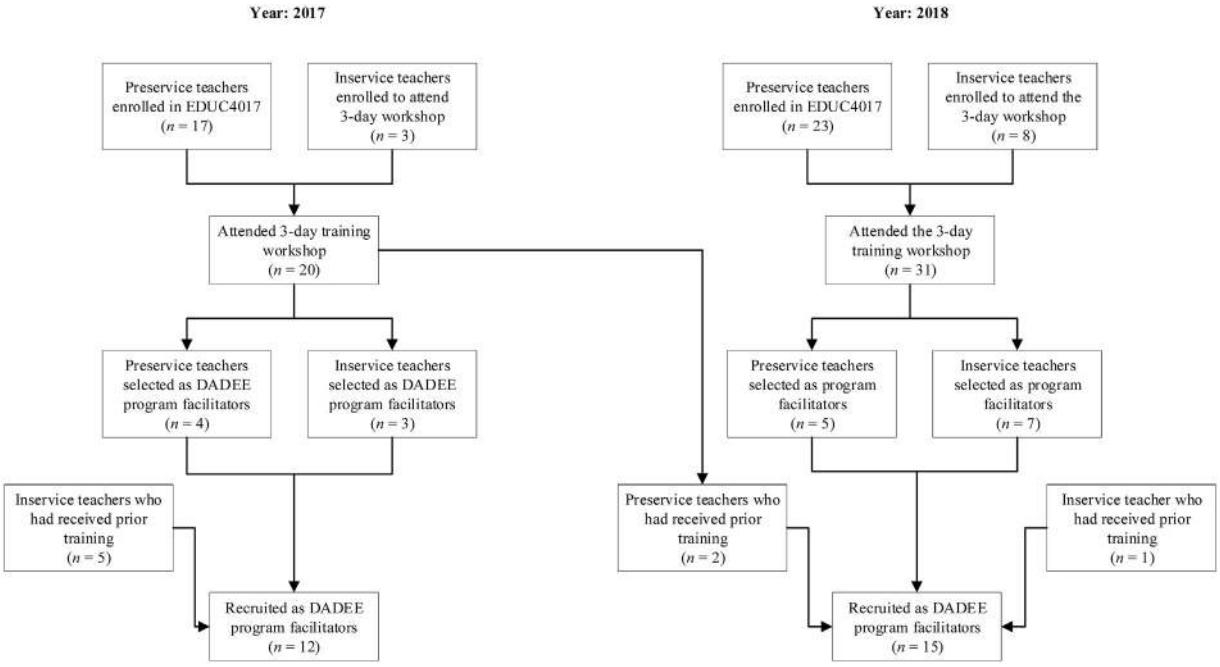

Fig. 1. Participant flow for recruitment of program facilitators.

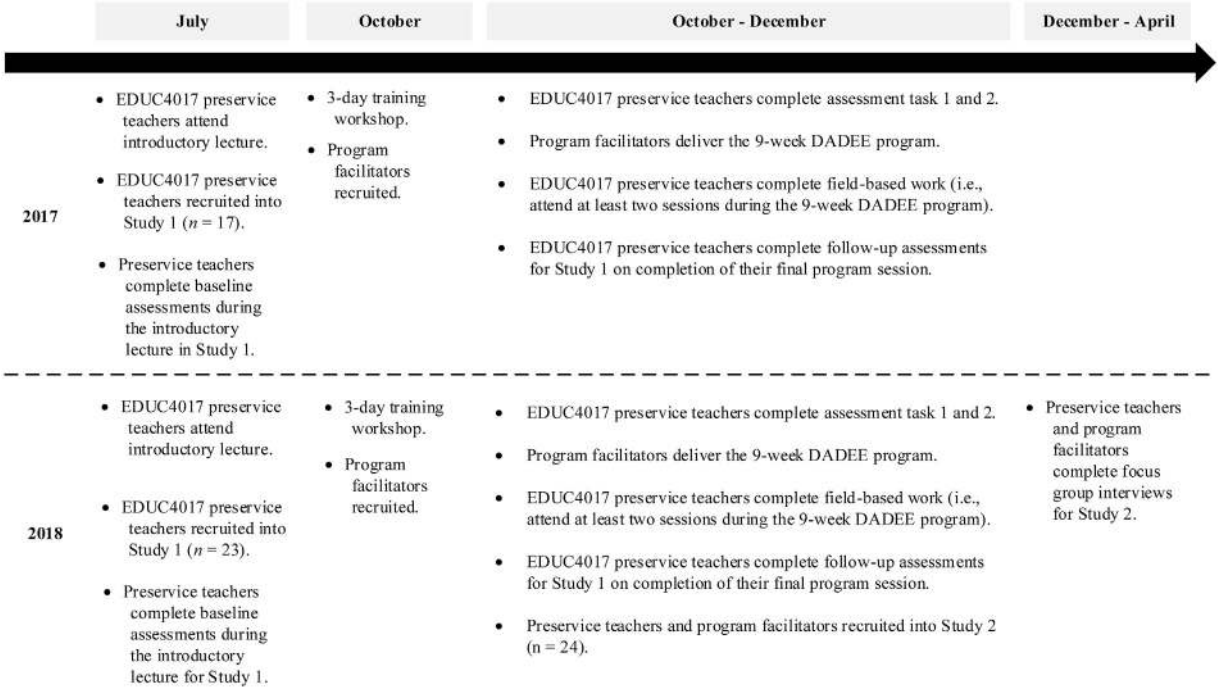

Fig. 2. Procedural timeline for study 1 and 2.

they observed (e.g., school uniform policies, teacher attitudes), and how the experience influenced their personal teaching beliefs and practices. Second, the preservice teachers recorded a video of themselves delivering a mock school staff meeting, where they outlined their ideas for an original school-based initiative to increase girls' physical activity by addressing gender bias.

2.2. Measures of study 1

Preservice teachers completed assessments at the beginning of the introductory lecture in July at the university and again at the end of the course during November–December. Data were collected over two years in separate courses in 2017 and 2018. However, the course was delivered by the same tutor in both years, and the content delivered was the same.

2.2.1. Implicit association test

Implicit attitudes relating to gender, physical activity and coordination were measured using a modified version of the Implicit Association Test (IAT) (Greenwald et al., 1998; Greenwald, Nosek, & Banaji, 2003). To reduce the time commitment, preservice teachers completed a paper-based version validated by Lemm, Lane, Sattler, Khan, and Nosek (2008), based on the original computerized version (Greenwald et al., 1998). The paper-based IAT has been shown to have adequate test-retest reliability ($r = 0.62$, $p < 0.001$ and $r = 0.49$, $p < 0.001$), which is similar to that of the traditional computer-based task ($r = 0.53$, $p < 0.001$ and $r = 0.45$, $p < 0.001$) (Lemm et al., 2008). The IAT is a timed categorization test that assesses the strength of biases towards a stereotype. Each IAT consists of a target (e.g., flowers-insects) and an attribute (e.g., good-bad), which are tested under two conditions (e.g., matched and mismatched).

For the current study, two IATs were created using targets and attributes selected by the authors. These included: (1) Target: boys-girls; Attribute: active-sedentary, and (2) Target: boys-girls; Attribute: coordinated-uncoordinated. In the first test, the boys-girls target was represented by three popular Australian female (e.g., *Emily*) and male (e.g., *Liam*) names and the active-sedentary attribute was represented by three words each, such as *athletics* and *reading*. In the second test, the boys-girls target was represented by the same names, however, the attributes included words associated with being coordinated (e.g., *skilled*) and uncoordinated (e.g., *unskillful*). Words were matched for length and ease of categorization. Selected girls' and boys' names were those that could not be considered both boys' and girls' names (e.g., *Ashley*). See Table 1 for all words used for the two IATs.

Participants first completed a practice test (see Table 2) unrelated to gender, physical activity or coordination. Next, participants completed the two tests, each under matched and mismatched conditions. To complete the test, participants were asked to categorize the words down the middle of the page, by either ticking the right or left-hand column. For example, in Fig. 3, the left-hand column should be ticked for the first word, *Emily,* as it is a girls' name. A tick should go on the right-hand column for the second word, *reading*, because it is a sedentary activity. Participants were given 20 s to categorize as many words as possible beginning at the top of the page. Participants were instructed to work as quickly and as accurately as they could, without skipping or stopping to correct errors. It was hypothesized, it would be easier and quicker for participants to classify words when the target and attribute matched negative associations towards girls (e.g., girls-sedentary), compared to the potentially contradictory pairings, such as girls and active. To prevent potential order effects, the participants were randomized to complete either the: (1) matched condition ($n = 20$) or (2) the mismatched condition ($n = 20$) first (Greenwald et al., 1998).

2.2.2. Explicit attitude measures

To assess explicit attitudes, participants completed two different 5-point Likert scales (Greenwald et al., 2003). Participants were asked what statement best describes them. Responses ranged from *I strongly associate sedentary with girl and active with boy* to, *I strongly associate active with girl and sedentary with boy*. Participants also completed this scale using the words *coordinated* and *uncoordinated* in place of *active* and *sedentary*.

In addition, participants completed a 5-point feelings thermometer for each of the four attributes (i.e., active and sedentary, coordinated and uncoordinated) (Greenwald et al., 2003). Participants were asked to rate how much they associate *active* with *boy/girl*. Answers included: *strongly boy*; *somewhat boy*; *neither boy nor girl*; *somewhat girl*; *strongly girl*. The explicit 5-point Likert and Thermometer scales used in the current study have been used by Greenwald et al. (2003) to test implicit-explicit correlations in relation to age, gender-science, race and election 2000 bias.

2.2.3. Demographic information

Preservice teachers completed questions on general demographics, which included items about age, sex, ethnicity, postcode, teaching degree program and year of study.

2.3. Analyses of study 1

The variable of interest for the IAT is the difference in the number of correct responses under the two different conditions. This is classed as the relative association strength. As recommended by Lemm et al. (2008), the IAT score was calculated using the product: square root of difference algorithm, which takes into account the difference score and the ratio of items completed. A higher positive total score indicates implicit bias towards boys, activity and coordination, a score of zero indicates no relative implicit preference, and a negative total score indicates implicit bias towards girls, activity and coordination. Participants with more than 20% errors or who had not completed at least 8 correct responses were excluded from the analysis (Lemm et al., 2008). This resulted in four participants being excluded from at least one IAT task at baseline or post-test. Data from participants who did not meet these IAT scale specific exclusion criteria were retained in all other analyses.

A thermometer difference score was produced by subtracting the two items (i.e., matched − mismatched condition) (Greenwald et al., 2003). Negative biases against girls were indicated by positive scores on the IAT and thermometer and Likert explicit attitude measures.

All statistical analyses were conducted in IBM SPSS Statistics 25.0 (Armonk, NY: IBM Corp). To indicate pre-program attitudes, single sample t-tests were conducted to determine whether the IAT and explicit thermometer scores were significantly different from zero. The Likert scales were tested from 3 (i.e., neutral). Changes in implicit and explicit attitudes were examined using linear mixed models adjusted for sex, age, socioeconomic status, degree, year the preservice teacher was enrolled in the course, baseline score and if they were a program facilitator. Linear mixed models are consistent with an intention-to-treat approach as they model missing responses with a likelihood-based analysis that includes all available

Table 1
Words used for the implicit association test.

Targets		Attributes			
Test 1 and 2		Test 1		Test 2	
Girls	Boys	Active	Sedentary	Coordinated	Uncoordinated
Lily	Liam	basketball	drawing	sporty	unskillful
Emily	Ethan	tennis	television	talented	clumsy
Sophie	Samuel	athletics	reading	skilled	incompetent

Table 2
Implicit association test order using mismatched condition first.

		Left-hand column		Right-hand column	
Step	Test	Target	Attribute	Target	Attribute
1	Practice test (mismatched)	insects	good	flowers	bad
2	Practice test (matched)	insects	bad	flowers	good
3	Test 1 (mismatched)	girls	active	boys	sedentary
4	Test 1 (matched)	girls	sedentary	boys	active
5	Test 2 (mismatched)	girls	coordinated	boys	uncoordinated
6	Test 2 (matched)	girls	uncoordinated	boys	coordinated

data. Effect sizes were represented with Cohen's *d* (mean change/standard deviation [*SD*] of change) and interpreted as small (d = 0.2), medium (d = 0.5), and large (d = 0.8; (Cohen, 1988). Differences between completers and drop-outs were assessed using independent samples t-tests and chi squared tests. Implicit and explicit scores were inspected for skewness. Pearson or Spearman's correlation coefficients were used where appropriate to identify associations at baseline. Significance was established where $p < 0.05$.

2.4. Results of study 1

2.4.1. Participant characteristics

The mean (*SD*) age of preservice teachers who completed the IAT and explicit measures was 23.0 (4.0) years. From the total of 40 preservice teachers, 65% were female. All participants were born in Australia and represented almost all socio-economic areas, and the majority of participants (80%) were studying a Bachelor of primary teaching. Follow-up data was collected from 73% of participants. See Table 3 for additional information on participant characteristics.

2.4.2. Preservice teachers' baseline implicit and explicit attitudes

At baseline, preservice teachers demonstrated strong automatic bias towards girls and sedentary attributes (mean = 2.75, $t(36) = 6.35$, $p < 0.001$, $d = 1.04$). Similarly, medium-to-strong biases were observed in preservice teachers' explicit attitudes towards girls and sedentary attributes (Likert: mean = 3.35, $t(39) = 3.82$, $p = <0.001$, $d = 0.6$; Thermometer: mean = 0.98, $t(39) = 4.57$, $p = <0.001$, $d = 0.72$). Slight implicit bias towards girls and the uncoordinated pairing (mean = 1.20, $t(38) = 2.07$, $p = 0.046$, $d = 0.33$), and medium explicit bias towards girls in relation to being uncoordinated was also observed (Likert: mean = 3.35, $t(39) = 3.34$, $p < 0.01$, $d = 0.53$; Thermometer: mean = 0.70, $t(39) = 3.56$, $p = <0.01$, $d = 0.56$). There were no significant differences in key baseline characteristics and outcome variables between those lost to follow-up and those retained (all p values > 0.05).

2.4.3. Effects of the teacher education course on preservice teachers' implicit and explicit attitudes

Changes in implicit and explicit attitudes following the teacher education course are reported in Table 4. To summarize, a significant improvement, represented by a large effect size, was observed in preservice teachers' negative implicit attitudes towards girls and activity ($p < 0.001$, $d = 1.2$). Improvements represented by a medium-to-large and large effect sizes were observed in preservice teachers' explicit attitude scores relating to girls and activity (Likert: $p = 0.03$, $d = 0.6$; Thermometer: $p < 0.001$, $d = 1.1$). A small-to-medium effect size was observed in preservice teachers' negative implicit biases towards girls and coordination ($p = 0.19$, $d = 0.4$). Medium-to-large and small-to-medium effect sizes were also observed for preservice teachers' negative explicit attitudes towards girls and coordination (Likert: $p = 0.02$, $d = 0.7$; Thermometer: $p = 0.33$, $d = 0.3$).

2.4.4. Correlations

Pearson correlation coefficients were used to identify associations between implicit and explicit attitudes at baseline. Small, positive associations were observed between implicit and explicit attitudes using the Likert scale ($r = 0.31$, $p = 0.06$) and Thermometer ($r = 0.26$, $p = 0.13$) in relation to activity. A significant, medium positive association was observed between the two explicit scores in relation to activity ($r = 0.55$, $p < 0.001$). However, no effect was observed for implicit and explicit attitudes relating to coordination (Likert: $r = 0.13$, $p = 0.43$; Thermometer: $r = 0.07$, $p = 0.66$), but a significant and large positive association was observed between both explicit scores for coordination ($r = 0.91$, $p < 0.001$).

3. Study 2

3.1. Methods of study 2

3.1.1. Design and participants

For this qualitative study, focus group interviews were conducted with preservice teachers who completed EDUC4017, and facilitators who delivered the DADEE program in the local community.

EDUC4017 Preservice Teachers. Preservice teachers who completed EDUC4017 in Semester 2 2018 ($n = 23$; as per Study 1), were invited via email to participate in focus group interviews at the end of the course. Fourteen preservice teachers returned consent.

DADEE Program Facilitators. Facilitators who delivered the DADEE program in 2018 ($n = 15$, 7 preservice teachers; 8 inservice teachers) were also invited via email to participate in focus group interviews on completion of program delivery. To clarify, the program facilitator role was not a requirement of EDUC4017. Of the 40 participants who completed quantitative measures in 2017 and 2018 in Study 1, 16 participated in focus group interviews in Study 2.

It is important to distinguish between the three levels of exposure participants received in relation to the teacher education course and DADEE program. To summarize, the three levels included: (1) preservice teachers who received the teacher education course only ($n = 9$), (2) preservice teachers who received the teacher education course and who were recruited as program facilitators to deliver the 9-week DADEE program ($n = 7$), and (3) inservice teachers who attended the 3-day workshop component of the teacher education course and who were recruited as program facilitators to deliver the 9-week DADEE program ($n = 8$). See Fig. 1 for additional detail regarding participant flow and Fig. 2 for a procedural timeline.

3.1.2. Delivery of the DADEE program

On completion of the 3-day training workshop in 2018, a select number of preservice and inservice teachers were recruited as

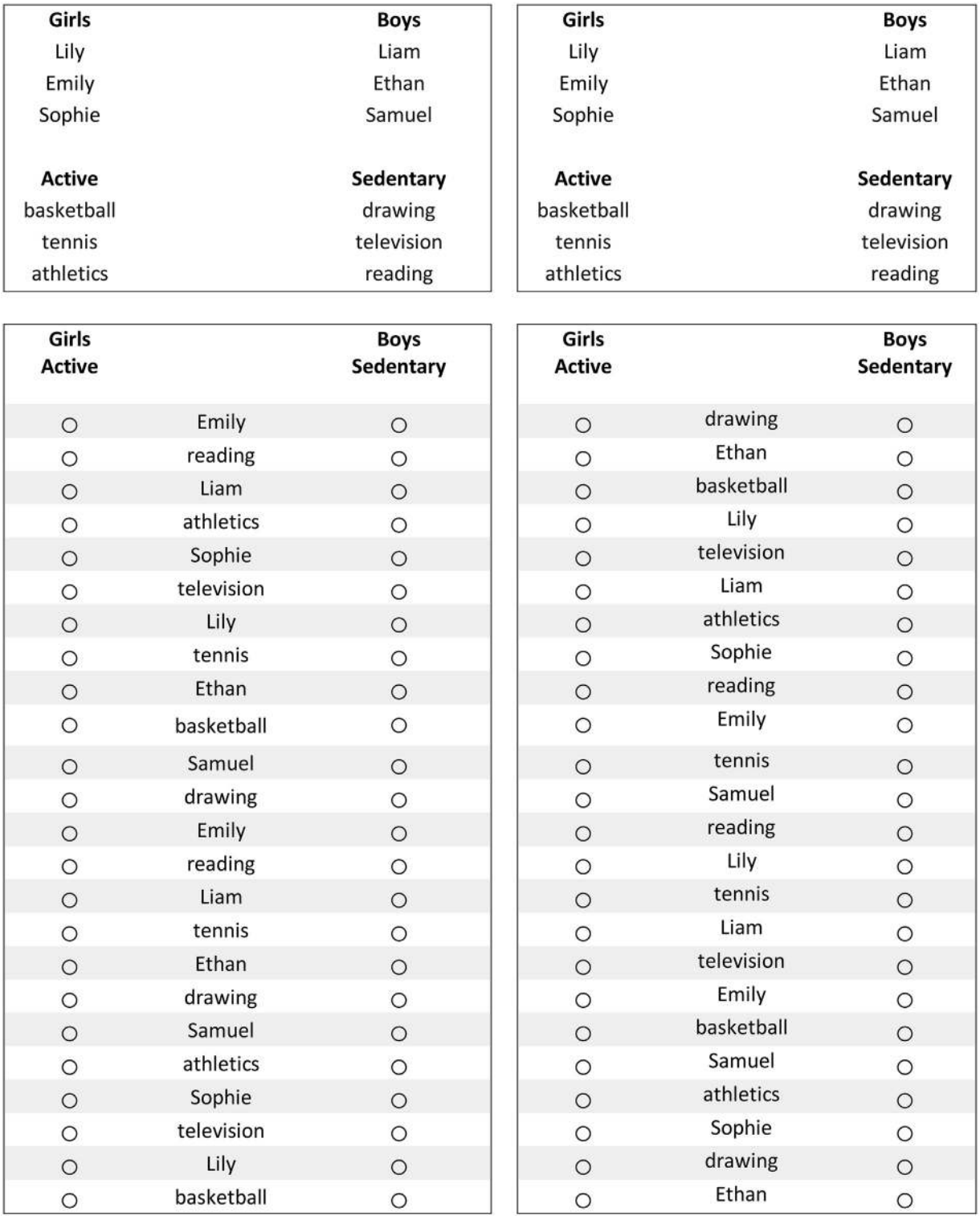

Fig. 3. Test 1, condition 1 (mismatched) and 2 (matched) paper-based implicit association test.

facilitators to deliver the 9-week DADEE program in the local community. Four separate programs were delivered, and each had a minimum of three facilitators. The weekly sessions ran for 90 min and included a daughters and dads' education session (15min), separate daughters' and dads' education sessions (30min), and a practical session for daughters and dads together (45min). Program facilitators had access to all program resources, including weekly program PowerPoints, practical session plans, and instructional videos via an online website portal.

3.2. Measures of study 2

Focus groups interviews were completed with preservice teachers and program facilitators on completion of the teacher

Table 3
Characteristics of participants.

Characteristics of preservice teachers who completed implicit and explicit attitude measures ($n = 40$)	Mean	*SD*
Age (years)	23.0	4.0
	n	**%**
Gender (female)	26	65
Australian born	40	100
Degree		
Bachelor of primary teaching	32	80
Bachelor of secondary teaching (Health and physical education)	8	20
Socio-economic status		
1-2 (lowest)	2	5
3–4	11	28
5–6	15	38
7–8	6	15
9-10 (highest)	6	15
Characteristics of participants who completed focus group interviews ($n = 24$)	**Mean**	***SD***
Age (years)	26.6	6.1
	n	**%**
Gender (female)	12	50
Australian born	24	100
Teaching		
Inservice teachers	8	33
Preservice teachers	16	67
Inservice teachers' teaching experience (years) ($n = 8$)		
<5	2	25
5–10	2	25
10–15	3	38
>15	1	13
Socio-economic status		
1-2 (lowest)	–	–
3–4	6	25
5–6	12	50
7–8	5	21
9-10 (highest)	1	4

education course and DADEE program between December 2018 and April 2019. Program facilitators completed a short survey prior to the interview to capture demographic information. Preservice teachers' demographic information had been previously collected in Study 1.

3.2.1. Focus group interviews

Focus group interviews were conducted to explore preservice teachers' experiences of EDUC4017 and facilitators' experiences of delivering the DADEE program. The 24 participants were spread across seven focus groups. Focus groups consisted of: (1) preservice teachers who completed EDUC4017 (3 x groups), (2) preservice teachers recruited as program facilitators (1 x group), (3) inservice teacher program facilitators (2 x groups), (4) mixed (1 x group). Each group had 2-4 participants and was organized based on participant availability. Focus group interviews took the form of semi-structured discussions, which allowed participants to interact with each other and share experiences and/or perspectives in a small-group setting (Hennink, 2013). This qualitative method is ideal for gaining rich and detailed insights into people's understandings of a topic, particularly one where they have a shared experience (Hennink, 2013). The topic guide was developed by the authors, and explored teachers' views on gender, teachers' attitudes and practices in relation to gender equity in school, their experiences with gender stereotypes and gender bias, and the impact of the teacher education course and DADEE program more broadly (e.g., family and community). See Table 5 for a full list of questions.

Focus groups were led by two female research assistants who were involved in the administration of the DADEE program, but not program or course delivery. Therefore, interviewers had no contact with participants prior to the interviews. Both research assistants were trained in conducting focus group interviews. Questioning and prompts were used to facilitate discussion and to elaborate on responses. Focus groups were run at the university and ranged in duration from 41 to 72 min.

3.2.2. Demographic information

Inservice teachers completed questions on general demographics, which included items about age, sex, ethnicity, postcode, and years of teaching experience.

3.3. Analyses of study 2

Focus groups were audio-recorded and transcribed verbatim. Transcripts were emailed to participants to comment on and/or correct, to which no participants responded. Analysis was conducted by author, VH using an inductive thematic analysis of the seven focus groups combined (Braun & Clarke, 2006). NVivo 12 was used to assist with the organizational aspects of the analysis. A hierarchical coding scheme was developed based on in vivo coding of the transcripts. This was an iterative process with the final coding scheme subsequently applied to the complete data set. This coding formed the basis for development of a thematic structure. All data falling under each theme and sub-theme were reviewed

Table 4
Changes in preservice teachers' implicit and explicit attitudes towards gender equity in physical activity and sport.

	Baseline		Changes in implicit and explicit attitudes following the teacher education course		
	n	Adjusted Mean (*SE*)	Mean [a] (95% *CI*)	Cohen's *d* [b]	*p* value
Implicit attitudes: Active-Sedentary	37	2.9 (0.31)	−2.21 (−3.21, −1.21)	1.2	<0.001
Explicit attitudes: Active-Sedentary Likert	40	3.34 (0.05)	−0.18 (−0.34, −0.02)	0.6	0.03
Explicit attitudes: Active-Sedentary Thermometer	40	0.93 (0.10)	−0.72 (−1.09, −0.36)	1.1	<0.001
Implicit attitudes: Coordinated-Uncoordinated	39	1.14 (0.46)	−1.11 (−2.80, 0.58)	0.4	0.19
Explicit attitudes: Coordinated-Uncoordinated Likert	40	3.36 (0.05)	−0.22 (−0.41, −0.03)	0.7	0.02
Explicit attitudes: Coordinated-Uncoordinated Thermometer	40	0.71 (0.14)	−0.25 (−0.76, 0.26)	0.3	0.33

Note. SE = Standard Error. CI = Confidence Interval.
[a] A reduction in the mean represents a reduction in negative bias towards girls.
[b] Cohen's *d* is interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$).

prompting minor changes to ensure that the thematic structure captured the entirety of the data. Thematic narratives were developed, supported by participant quotes and reviewed by author EP.

3.4. Results of study 2

3.4.1. Participant characteristics

The mean (*SD*) age of the participants who completed focus group interviews was 26.6 (6.1) years and half of the participants were female. All participants were Australian born and were represented from almost all socio-economic areas. Two thirds were preservice teachers (67%) and inservice teachers' teaching experience ranged from 1 to 17 years. Additional demographic data is available in Table 3.

3.4.2. Focus group findings

Thematic analysis of the seven focus groups identified four key themes. These themes related to the impact of the teacher education course and DADEE program. Themes included: (1) increased awareness of gender bias and inequity; (2) better skills and strategies to address gender-related issues; (3) improved ability to promote gender equity in schools; and (4) advocating for gender equity in the community. The data from the focus groups have been combined in the analyses due to the interconnected nature of preservice teachers' and program facilitators' experiences.

3.4.3. Increased awareness of gender bias and inequity

All participants spoke of a heightened sense of awareness and increased ability to identify gender stereotypes and biases that negatively impact girls. For example, one preservice teacher mentioned that, "[the training] opened my mind up to seeing the actual gender bias when you're out in the world" (FG 01, male preservice teacher). Another preservice teacher mentioned that the teacher education course "… definitely had a massive impact in the way I looked at gender … Like I can't unsee a lot of the things" (FG 02, male preservice teacher). This was operationalized in the program as wearing your 'gender glasses' (Mackoff, 1996), and was one of the most important outcomes of the training:

> I think the thing that impacted me the most was the 'gender glasses' … I know that they jokingly told us that you won't see things the same way when you leave. But when I left [the training], every store that I went into or every little comment that someone would say, I would notice. (FG 06, female preservice teacher)

Although more than half of the participants mentioned that they already had some sense of the impact of gender, their capacity to detect how gender biases operate vastly improved:

> I don't think I've changed the way I see it [gender]. I think I've always seen it as, you know, males and females are equal. But I've definitely seen more things in the community that kind of concern me … I definitely notice it a lot more. (FG 01, female preservice teacher)

This heightened sense of awareness enabled participants to

Table 5
Semi-structured focus group interview guide.

Discussion guide questions	Questions directed to:
• Can you tell me about your reasons for getting involved in EDUC4017 and/or the DADEE program?	• Inservice teacher program facilitators • Preservice teacher co-facilitators • Preservice teachers
• Did you find the 3-day workshop had any impact on you? If yes, what was the most relevant and impactful and why?	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• What have your experiences been whilst attending/delivering the DADEE program sessions?	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Can you tell me about any positive/negative aspects that you experienced whilst attending/delivering the DADEE program sessions? Please explain.	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Have you noticed any changes to your teaching beliefs or practices since your involvement in the program? If yes, can you provide examples?	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Thinking about the information you learnt in relation to pinkification ('gender glasses'), can you share any positive or negative observations of gender bias or gender stereotypes that you saw during practicum or internship? If yes, can you explain what happened?	• Preservice teacher program facilitators • Preservice teachers
• Have you or do you plan to speak up or make any changes within your school since learning about pinkification and 'gender glasses'? If yes, please provide examples.	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Have you changed the way you see gender in your day to day lives? If yes, please provide examples.	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Has your involvement in the DADEE program changed your views regarding gender stereotypes and gender bias experienced by girls in sporting, school and family contexts? If yes, please provide examples.	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers
• Has there been any impact on the children you teach? If yes, in what way?	• Inservice teacher program facilitators
• Has the DADEE program impacted you more broadly (e.g., personally, your family, the community)? If yes, please provide examples.	• Inservice teacher program facilitators • Preservice teacher program facilitators • Preservice teachers

identify gender biases and inequities at personal (e.g., identifying their own unintentional biases), family (e.g., the way they parent their daughter), school (e.g., gendered language, uniform policies), and community levels (e.g., gendered marketing). Notably, numerous participants who were parents or parents-to-be shared that the learnings from the training was highly beneficial to their role as a parent.

Many voiced a newly developed ability to identify and acknowledge the impact of gender biases inherent within their schools, such as issues relating to school uniforms, gendered language, and gender representation in school sporting teams. Additionally, more than half of the participants described explicit examples of gender bias they observed in schools. One participant (FG 07, female preservice teacher) shared, "My CT on internship … she took her Year 8 class out for volleyball … every kid was letting it bounce and then she just said, "Stop playing like a bunch of girls"". Similarly, another preservice teacher (FG 07, male) mentioned, "In my class … the teacher would often ask me to take out the boys for sport … She'd just automatically assume that they [the girls] wouldn't be interested or they wouldn't enjoy playing sport."

This new focused attention did not apply only to instances of inequity, but also allowed some preservice teachers to notice positive examples of gender equity.

Participants attributed this newfound awareness to the knowledge learnt during the 3-day workshop and reinforcement of this information through observing and delivering the DADEE program. One preservice teacher mentioned, "...getting out and actually observing it [the program], seeing the dads and the daughters enjoying it was definitely worthwhile. I think that was the most positive thing for me" (FG 01, female). One inservice teacher mentioned that the training, "… arms you with knowledge, it arms you with data … so it's definitely had an influence on my teaching" (FG 04, male).

3.4.4. Better skills and strategies to address gender-related issues

As a result of the 3-day workshop, more than half of the participants felt that they had gained a new set of strategies (e.g., applying autonomy to lessons, modifying lessons to promote inclusivity, and inclusive language) and skills (e.g., ability to deal with difficult situations relating to gender, improved confidence to discuss gender equity) to encourage girls' participation in physical activity and sport. Preservice and inservice teachers looked forward to incorporating the newly learnt perspectives and practical skills in their schools to encourage more equitable and inclusive teaching.

Most participants mentioned that they had developed a greater sense of using gendered terms such as "sweetie", "guys", and prided themselves in replacing these with alternative phrases. Moreover, some participants spoke about a new set of terminology for having conversations at school with the aim of facilitating gender equity rather than focusing on girls' appearances:

> One of the big ways, as a female, to build rapport with some of my students, especially teenage girls, usually the first thing you'll go to talk to them about, is their appearance. So you're like, "I like your hair today" and I find myself, I go to say it and then I go no. Instead I go, "how was your weekend" or "you look like you're having a really good day". Just to take that language away from the appearance, because I do know how damaging that is. (FG 04, female inservice teacher)

One inservice teacher (FG 04, male) went as far to say that the training provided him with a "universal language" to use with his students, while another preservice teacher said that he now has a "language that you can use to make the girls feel inclusive." (FG 01, male preservice teacher)

Around half of the participants revealed that they gained a new confidence to use a less passive approach to girls' reluctance to participate in physical activity. One female preservice teacher (FG 01) shared that, "The course reinforced that I should be encouraging [girls] more. Instead of just being like, "yeah, well okay if you don't feel like it"". Similarly, another preservice teacher (FG 03, male) explained, "I always try and go out of my way to get a game going with [the girls], some form of game so that they're having fun, they're building their skills".

Some preservice teachers alluded to a regret that the knowledge, skills and awareness, which had come out of the course had come late in their university degree:

> I wish I had this course or this knowledge at the very start of the degree before I went out into schools. Because I feel like I would've realized so many more different things that were occurring like gender bias wise if I had this like research prior to going out on my first prac even. (FG 01, female preservice teacher)

3.4.5. Improved ability to promote gender equity in schools

Involvement in the teacher education course and DADEE program had for some participants translated into more deliberate actions to challenge the status quo, including: championing gender equity during professional development days, ensuring there are equal opportunities for boys and girls for representative school sport, and advocating for change with regards to equal access to playground spaces within school during breaks:

> I even spoke to [the principal] about the opportunity of maybe creating spaces on the playground that were gender specific, so from my observations of just walking around the school during the time of teaching the DADEE Program, you know, 90% of the space was dominated by boys. (FG 04, male inservice teacher)

One inservice teacher was instrumental in bringing about school uniform changes at his school:

> … I've been pretty vocal about, you know, even the younger years, kinder[garton] through should wear it. And they've changed that. So, from kinder through to year 8, they wear their PE uniform every day of the week. (FG 05, male inservice teacher)

At the class level, deliberate attempts to include more female sporting examples during lessons also occurred. Participants attributed these new actions to having a wide acknowledgement of the consequences of even minor actions, and the potential long-term impacts of gender bias and stereotypes on the lives of their female students:

> … making everyone aware that like, these crappy [bad] little things that we do, that we don't even notice that we're doing, can make a huge difference in the girls' lives. (FG 07, female preservice teacher)

Underlying these actions was also an improved confidence in speaking up on gender-related issues within the school setting, which for some, was attributed to having the evidence-based research to back them up. While some took deliberate action, more than half of the participants described how the teacher education course and the DADEE program became a catalyst for an increased sense of urgency and confidence in having conversations about

gender and educating others about the impact of gender biases:

> If I am employed by a school that does not meet the standards with uniform or gender bias anyway, then yes, I'll definitely speak up and it's because of the DADEE course. (FG 03, male preservice teacher)

3.4.6. Advocating for gender equity in the community

For most participants, discussion relating to societal level impact of the program centered on its potential to make sustainable changes. One participant described the teacher education course and DADEE program's ethos as "weeding its way in" to society, while others described societal level impact as a "snowball" or "domino" effect:

> I guess it's now we have the knowledge to educate other staff to make sure that this message isn't just going to the people doing this course … Because that's the only way it's going to change. Otherwise, it's just going to keep filtering through, um, and we're going to have the same problems. So I guess it's up to everyone that like does this course to share that knowledge. (FG 01, male preservice teacher)

A number of participants indicated a new empowerment to be advocates for societal changes in gender equity into the future, as they reflected on their important roles as educators:

> … especially being young teachers as well, you know, we plan on being in the profession for 20, 30 years, it's like, it's going, we're going to have to be the people who change that. (FG 03, male preservice teacher)

One inservice teacher's new empowerment translated into a community-wide action:

> … I'm actually starting, in term two, there's a fair few boys [friends] that have got young daughters, so I'm going to open up our school hall, of a Saturday morning and just, just play whatever. Just a heap of games. (FG 07, male inservice teacher)

While another participant's newfound empowerment translated into actions in relation to her role as a mother, "I am really funny like buying clothes and things now … I am really not into covering her [daughter] in pink just because she's a girl." (FG 02, female preservice teacher)

Many participants alluded to testing their newfound arguments and discoveries around gender with their families and friends. One preservice teacher said, "family friends or friends that have little daughters, it changes the way that you kind of interact with them" (FG 03, male preservice teacher). While another preservice teacher mentioned:

> … I was actually, I was telling dad about the course and, um, was just sort of testing his views on it and I've got my younger sister and I was like, "If she was to walk into the room, how would you compliment her?" (FG 02, male)

Also, some teachers said they had "unplanned" conversations out in the local community with fathers who attended the DADEE program. Those fathers prided themselves in continuing the program's ethos.

Certainly, this lasting impact beyond the boundaries of the course and DADEE program was one which excited some preservice teachers and gave a real meaning to it as a potential catalyst for some more systemic changes in gender dynamics:

> Now that I've done the DADEE program, done the facilitating, I cannot wait to go to a country town and try and start changing the mentalities out there. Because it's still a bit behind. (FG 06, female preservice teacher).

4. Discussion

The purpose of Study 1 was to explore the impact of a teacher education course on preservice teachers' implicit and explicit attitudes towards gender equity in physical activity and sport. Study 2 set out to explore in greater detail, the impact and effectiveness of the course in relation to pre-existing negative biases using qualitative methods, to understand teachers' experiences of the course, as well as themes related to gender equity and girls' participation in physical activity.

Prior to the teacher education course, preservice teachers held strong implicit associations between girls and sedentary attributes, and slight implicit associations between girls and uncoordinated attributes. Preservice teachers also reported medium-to-strong and medium explicit associations between girls and sedentary, and uncoordinated attributes respectively. At follow-up, improvements were observed in preservice teachers' negative implicit attitudes towards girls and activity (represented by a large effect size), and their negative implicit attitudes towards girls and coordination (represented by a small-to-medium effect size). Further, significant improvements were observed for preservice teachers' negative explicit attitudes towards girls in relation to activity, represented by medium-to-large and large effect sizes. A significant improvement was observed for preservice teachers' negative explicit attitudes towards girls using the Likert scale (represented by a medium-to-large effect size), however, only a small improvement was observed for changes in explicit attitudes using the thermometer measure.

Thematic analysis of the focus group interviews in Study 2, revealed preservice teachers gained a new ability to detect gender biases and inequities, and the negative consequences on girls' opportunities to be physically active or to participate in sport. More importantly, teachers gained a realization of their influential role to address gender-related issues within their schools. The 3-day training workshop and involvement in the DADEE program provided teachers with the skills and strategies to promote and encourage gender equity, which resulted in a new confidence to advocate and action for positive change within schools. More broadly, preservice and inservice teachers planned for, and advocated for gender equity within the community.

4.1. Teachers' implicit and explicit attitudes towards girls in relation to physical activity and coordination at baseline

At baseline, preservice teachers held significant pre-existing implicit gender biases against girls, particularly in relation to physical activity ($d = 1.2$). This is of concern, as preservice teachers' subconscious implicit attitudes may reflect traditional attitudes (i.e., associating girls with being sedentary), which could have negative consequences for girls' opportunities in physical activity and sport. Effect sizes for explicit attitudes for physical activity (Likert: $d = 0.6$; Thermometer: $d = 0.72$) were not as strong as implicit attitudes, which is consistent with another study examining race bias (Greenwald et al., 1998). Given that explicit attitudes are consciously accessible, they are subject to social desirability or

self-presentation, particularly when assessing social groups that already experience prejudice (e.g., the poor, African Americans) (Nosek, 2005; Nosek et al., 2002). Admitting to having negative attitudes towards girls, and associating them more with being sedentary, could potentially be viewed as culturally unacceptable, which may explain the stronger biases observed for implicit attitudes when compared to explicit attitudes (Greenwald et al., 1998).

The same pattern was not observed in relation to implicit and explicit attitudes towards girls and coordination. While significant implicit and explicit negative biases towards girls were present, slightly larger explicit attitude effect sizes were observed (Likert: $d = 0.53$; Thermometer: $d = 0.56$) when compared to implicit attitudes ($d = 0.33$). The coordinated-uncoordinated IAT included descriptive words such as *unskillful*, *clumsy*, *sporty*, *talented* and *skilled*, which may not have been representative of coordinated or uncoordinated attributes. As such, descriptive words should be tested for validity in future iterations of this study. However, explicit attitudes are still noteworthy, and suggest preservice teachers have negative biases towards girls and their skills.

Consistent with previous studies, small, positive associations were observed between implicit and explicit attitudes relating to activity (Greenwald et al., 1998, 2003). However, in contrast, weak associations were observed for implicit and explicit attitudes relating to coordination. Although researchers suggest that implicit and explicit measures are related (Nosek, 2005), the degree of correlation greatly varies amongst studies, ranging from $r = 0.07$ to $r = 0.7$ (Forscher et al., 2019). Researchers suggest that the variation in implicit-explicit relations can be explained by social sensitivity of targets and attributes, the degree participants have thought about the concepts, the degree of the targets and attributes opposing each other, and the degree of which a person views their own evaluation of the concepts as unique compared to others (Forscher et al., 2019; Nosek, 2005). Thus, implicit-explicit associations can be influenced by external variables, which may explain the mixed associations in the current study.

4.2. Changes in teachers' implicit and explicit attitudes following the teacher education course

A notable finding from the current study was that preservice teachers greatly reduced their negative implicit associations between girls and sedentary attributes, represented by a large effect size. This finding is substantive, as a recent meta-analysis of 492 studies found that changes in implicit attitudes tend to be weak ($ds < 0.30$) (Forscher et al., 2019). Although some studies have had success in reducing negative implicit bias (Devine, Forscher, Austin, & Cox, 2012; O'brien, Puhl, Latner, Mir, & Hunter, 2010), uncertainty remains in the overall effectiveness of real-world bias-reducing interventions, primarily due to small sample sizes (FitzGerald et al., 2019; Paluck & Green, 2009). Therefore, larger scale interventions are required. Of note is that, somewhat large confidence intervals were observed for implicit attitude changes. However, the current effect sizes could be used to increase statistical precision in future studies.

Although rigorous data for the effectiveness of bias reducing interventions in the real-world context is lacking, researchers have identified promising implicit bias-reducing intervention techniques, such as strategies to override or suppress bias, exposure to counter stereotypical examples, and invoking goals and motivations (FitzGerald et al., 2019; Forscher et al., 2019). One notable 12-week longitudinal study that used a randomized controlled design with 91 participants, reduced implicit race bias using a habit-breaking intervention (Devine et al., 2012). The intervention included a 45min education and training session, where participants received feedback on their level of implicit biases, were educated on the consequences of race-bias, and received a host of strategies. Participants were also encouraged to report and reflect on the strategies they used. Notably, reductions in implicit race-bias was sustained 8-weeks after training. Like the intervention tested by Devine and colleagues, the current study used a longer duration, multi-faceted approach (i.e., education, observation and application), which may have contributed to the large reductions in negative implicit bias towards girls and physical activity (FitzGerald et al., 2019).

Another positive finding was the effect the course had on reducing preservice teachers' negative explicit associations between girls and sedentary attributes (Likert: d = 0.6; Thermometer: d = 1.1). Research suggests that explicit attitude changes tend to be inconsistent, and results weaker when compared to implicit attitudes (Forscher et al., 2019). Combined with the reductions in negative implicit attitudes, these novel experimental data provide support for targeting preservice teachers to address gender inequity in schools, as changes in both implicit and explicit attitudes may lead to improvements in teachers' behaviors (Forscher et al., 2019).

One such reason for the lack of changes in implicit attitudes towards girls and coordination, may be the teacher education course's major focus on improving girls' physical activity levels. To produce greater changes in negative implicit attitudes towards girls and coordination may require a much more targeted approach. Despite favorable changes in implicit and explicit attitudes towards girls and physical activity, changes in attitudes of preservice teachers towards girls and coordination were mixed. A medium-large effect size was observed for changes in explicit attitudes using the Likert scale, but not for implicit attitudes or explicit attitudes using the thermometer scale. As such, explicit results should be treated with caution. Although our preliminary findings are promising for explicit changes using the Likert scale, further research is required to understand the use of different explicit attitude measures. It seems that Likert scales are more commonly used to measure changes in explicit attitudes (Devine et al., 2012; O'brien et al., 2010; Wijayatunga, Kim, Butsch, & Dhurandhar, 2019), which may be a better option in future studies.

4.3. Teachers' perceptions of the impact of the teacher education course and DADEE program on attitudes and practices related to gender in physical activity and sport

Our qualitative findings revealed that preservice and inservice teachers gained a newfound awareness and ability to detect gender biases and inequities, and understand their consequences. This is important information given that gender equity awareness in teachers plays an integral role in achieving gender equity within schools (Esen, 2013; Parri & Ceciliani, 2019; Valley & Graber, 2017). Notably, the teacher education course and DADEE program gave preservice teachers new knowledge, and a language for articulating in real-world situations, which contributed to them wanting to find ways of addressing gender bias in their own personal lives, teaching, and broader societal contexts.

According to Davis (2003), gender inequity in schools should be addressed through verbal interactions, perceived physical differences, class management, teaching styles and strategies, and curriculum. Notably, these were all covered in the training workshop. Teachers spoke of new strategies such as, replacing gender biased language, promoting equal interactions with students, providing modifications of activities, sharing examples of female sporting figures, and providing equal opportunities in representative sport. Importantly, most preservice teachers were able to apply and practice these new evidence-based learnings during the DADEE program sessions and/or during university practicum held

concurrently to the course, which may be beneficial in regulating implicit and explicit bias.

The current study found that a teacher education course has the potential to create a ripple effect with widespread influence. For example, teachers gained a new sense of confidence in their ability to communicate with others regarding gender-related issues and many became gender equity advocates within their schools. Teachers made micro-level class changes, such as including more female sporting examples, removing gender biased language and promoting more opportunities for girls. However, in addition, inservice teachers were integral in implementing macro-level, whole school approaches, such as, addressing school uniform policy issues, advocating for equal playground use for all students, championing gender equity during professional development days, and ensuring equal opportunities in representative school sport. Esen (2013) previously mentioned that education is a key driver for social change relating to gender equality, suggesting that even micro-level strategies can trigger changes in deconstructing the multiple layers of traditional gender norms, attitudes and beliefs.

Parri and Ceciliani (2019) also recognized that social and cultural environments are important in erasing gender differences. Although this study specifically targeted preservice and inservice teachers, and their personal attitudes and practices within the school setting, there was evidence to suggest that the teacher education course and facilitating the DADEE program had a far-reaching "domino" effect at the societal level. For example, preservice and inservice teachers delivered sport programs outside of school hours for friends and their daughters, instigated conversations with people in the local community regarding gender-related issues, and intended on making systematic changes in their hometowns. As such, empowering preservice and inservice teachers to commit to and take personal responsibility in influencing girls' experiences in schools, could have major implications for girls' physical and mental health beyond schools.

4.4. Strengths and limitations

There are several strengths of this study. First, the current study included both preservice and inservice teachers. Second, a mixed methods approach was undertaken to provide a more in-depth understanding into teachers' attitudes towards gender, and the impact of the teacher education course and inservice training (e.g., IAT, explicit attitude measures and focus group interviews). The current study measured both implicit and explicit attitudes to gain a better understanding of teachers' conscious and subconscious attitudes. Third, the teacher education course focusing on gender can be incorporated into the curriculum for preservice teachers, so that future teachers are equipped with the knowledge and skills prior to teaching in schools. Lastly, an external researcher conducted the focus group analysis.

There are also limitations to this study that should be addressed. Notably, the present study used a single-group pre-post-test design. It was beyond the scope of the current study to have a control group for both logistic (e.g., study budget) and study purpose reasons. For example, this was designed as an exploratory study of a novel approach to addressing gender inequity. Thus, potential training effects may threaten the internal validity of the data. Given the exploratory nature of this study, caution should be made in the interpretation of the quantitative results. Additionally, our sample for quantitative measures was limited to preservice teachers enrolled in two classes, delivered in consecutive years, by the same tutor. As such, future studies are needed to replicate our findings using a randomized controlled trial design with larger sample sizes and long-term follow-up to test if changes can be sustained.

While the paper-based version of the IAT provides greater flexibility with regards to measuring multiple participants simultaneously, and is more cost effective than the computerised version, it does not come without limitations. For example, studies have demonstrated test-retest reliability of around $r = 0.56$ for the paper-based IAT (Lane, Banaji, Nosek, & Greenwald, 2007; Nosek, Greenwald, & Banaji, 2007). Moreover, Schimmack (2019) recently highlighted the implications of construct validity variability of the IAT. However in rebuttal, Vianello and Bar-Anan (2020, p.415) concluded that "the IAT is the best available candidate for measuring automatic judgement at the person level." Given that the paper-based implicit association test is a relatively new measure when compared to the traditional computer-based version, more research is required in relation to the reliability of the IAT in testing automatic associations. In terms of the focus groups, due to budget constraints, a single external researcher analyzed the interview data. Although the current study combined the thematic analysis due to the interconnected nature of study participants, it would be useful to determine if preservice teachers and program facilitators had differing insights into the most effective strategies for addressing gender equity in schools.

5. Conclusion

Many teachers are unaware of their own biases, lack the knowledge to identify gender inequities, and the skills to implement equitable teaching practices. Therefore, for teachers to become effective agents of gender equity change, it is critical for them to be alerted to their own biases, understand practices that reproduce harmful gender stereotypes and their consequences, and commit to their role in creating a gender inclusive environment. This study has provided experimental evidence suggesting that a teacher education course has the potential to change teachers' subconscious and deliberate thoughts, and address gender-related issues that hinder girls' opportunities to be physically active and participate in sport. Study findings have particular relevance to quality teaching in education, as teachers who receive gender equity training may create more equitable learning environments for their students, and become gender equity advocates within the broader school-community environment.

Author contributions

Emma Pollock: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Writing - Review & Editing, Project administration **Myles Young:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing - Review & Editing, Project administration **David Lubans:** Conceptualization, Methodology, Writing - Review & Editing **Julia Coffey:** Conceptualization, Methodology, Writing - Review & Editing **Vibeke Hansen:** Methodology, Formal analysis, Writing - Review & Editing **Philip Morgan**: Conceptualization, Methodology, Formal analysis, Resources, Writing - Review & Editing, Supervision, Funding acquisition. All authors have approved the manuscript and agree with its submission to the Teaching and Teacher Education.

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Declaration of competing interest

The authors declare that they have no conflict of interest.

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References

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erbaum Press.

Davis, K. (2003). Teaching for gender equity in physical education: A review of the literature. *Women in Sport & Physical Activity Journal, 12*(2), 55–81. https://doi.org/10.1123/wspaj.12.2.55

de Kraker-Pauw, E., van Wesel, F., Verwijmeren, T., Denessen, E., & Krabbendam, L. (2016). Are teacher beliefs gender-related? *Learning and Individual Differences, 51*, 333–340. https://doi.org/10.1016/j.lindif.2016.08.040

Devine, P. G., Forscher, P. S., Austin, A. J., & Cox, W. T. (2012). Long-term reduction in implicit race bias: A prejudice habit-breaking intervention. *Journal of Experimental Social Psychology, 48*(6), 1267–1278. https://doi.org/10.1016/j.jesp.2012.06.003

Dudley, D. A., Cotton, W. G., Peralta, L. R., & Winslade, M. (2018). Playground activities and gender variation in objectively measured physical activity intensity in Australian primary school children: A repeated measures study. *BMC Public Health, 18*(1), 1101. https://doi.org/10.1186/s12889-018-6005-5

Dumith, S. C., Gigante, D. P., Domingues, M. R., & Kohl, H. W., III (2011). Physical activity change during adolescence: A systematic review and a pooled analysis. *International Journal of Epidemiology, 40*(3), 685–698. https://doi.org/10.1093/ije/dyq272

Eather, N., Bull, A., Young, M. D., Barnes, A. T., Pollock, E. R., & Morgan, P. J. (2018). Fundamental movement skills: Where do girls fall short? A novel investigation of object-control skill execution in primary-school aged girls. *Preventive Medicine Reports, 11*, 191–195. https://doi.org/10.1016/j.pmedr.2018.06.005

Eime, R., Harvey, J., Charity, M., & Payne, W. (2016). Population levels of sport participation: Implications for sport policy. *BMC Public Health, 16*(1), 752. https://doi.org/10.1186/s12889-016-3463-5

Erden, F. T. (2009). A course on gender equity in education: Does it affect gender role attitudes of preservice teachers? *Teaching and Teacher Education, 25*(3), 409–414. https://doi.org/10.1016/j.tate.2008.11.001

Esen, Y. (2013). Making room for gender sensitivity in pre-service teacher education. *European Researcher, 61*, 2544–2554.

Fisette, J. L. (2013). 'Are you listening?': Adolescent girls voice how they negotiate self-identified barriers to their success and survival in physical education. *Physical Education and Sport Pedagogy, 18*(2), 184–203. https://doi.org/10.1080/17408989.2011.649724

FitzGerald, C., Martin, A., Berner, D., & Hurst, S. (2019). Interventions designed to reduce implicit prejudices and implicit stereotypes in real world contexts: A systematic review. *BMC Psychology, 7*(1), 29. https://doi.org/10.1186/s40359-019-0299-7

Forscher, P. S., Lai, C. K., Axt, J. R., Ebersole, C. R., Herman, M., Devine, P. G., et al. (2019). A meta-analysis of procedures to change implicit measures. *Journal of Personality and Social Psychology, 117*(3), 522. https://doi.org/10.1037/pspa0000160

Greenwald, A., McGhee, D., & Schwartz, J. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*(6), 1464–1480.

Greenwald, A., Nosek, B., & Banaji, M. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*(2), 197–216. https://doi.org/10.1037/0022-3514.85.2.197

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles, 66*(3–4), 153–166. https://doi.org/10.1007/s11199-011-9996-2

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: A pooled analysis of 298 population-based surveys with 1· 6 million participants. *The Lancet Child & Adolescent Health, 4*(1), 23–35. https://doi.org/10.1016/S2352-4642(19)30323-2

Hennink, M. M. (2013). *Focus group discussions*. New York, NY: Oxford University Press.

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 40. https://doi.org/10.1186/1479-5868-7-40

Jung, J., Ressler, J., & Linder, A. (2018). Exploring the hidden curriculum in physical education. *Advances in Physical Education, 8*, 253–262. https://doi.org/10.4236/ape.2018.82023

Lane, K. A., Banaji, M. R., Nosek, B. A., & Greenwald, A. G. (2007). Understanding and using the implicit association test: IV: What we know (so far) about the method. In B. Wittenbrink, & N. Schwarz (Eds.), *Implicit measures of attitudes* (pp. 59–102). New York, NY: The Guilford Press.

Lautenbach, F., & Antoniewicz, F. (2018). Ambivalent implicit attitudes towards inclusion in preservice PE teachers: The need for assessing both implicit and explicit attitudes towards inclusion. *Teaching and Teacher Education, 72*, 24–32. https://doi.org/10.1016/j.tate.2018.01.003

Lemm, K. M., Lane, K. A., Sattler, D. N., Khan, S. R., & Nosek, B. A. (2008). Assessing implicit cognitions with a paper-format implicit association test. In M. A. Morrison, & T. G. Morrison (Eds.), *The psychology of modern prejudice*. Hauppauge, NY, US: Nova Science Publishers.

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents. *Sports Medicine, 40*(12), 1019–1035. https://doi.org/10.2165/11536850-000000000-00000

Lynagh, M., Cliff, K., & Morgan, P. J. (2015). Attitudes and beliefs of nonspecialist and specialist trainee health and physical education teachers toward obese children: Evidence for "anti-fat" bias. *Journal of School Health, 85*(9). https://doi.org/10.1111/josh.12287

Mackoff, B. (1996). *Growing a girl: Seven strategies for raising a strong, spirited daughter*. New York, NY: Dell.

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport, 71*(3), 249–259. https://doi.org/10.1080/02701367.2000.10608905

Metcalfe, S. (2018). Adolescent constructions of gendered identities: The role of sport and (physical) education. *Sport, Education and Society, 23*(7), 681–693. https://doi.org/10.1080/13573322.2018.1493574

Mitchell, B., McLennan, S., Latimer, K., Graham, D., Gilmore, J., & Rush, E. (2013). Improvement of fundamental movement skills through support and mentorship of class room teachers. *Obesity Research & Clinical Practice, 7*(3), e230–e234. https://doi.org/10.1016/j.orcp.2011.11.002

Morgan, P. J., Young, M. D., Barnes, A. T., Eather, N., Pollock, E. R., & Lubans, D. R. (2019). Engaging fathers to increase physical activity in girls: The "Dads And Daughters Exercising and Empowered" (DADEE) randomized controlled trial. *Annals of Behavioral Medicine, 53*(1), 39–52. https://doi.org/10.1093/abm/kay015

Mukherjee, S., Ting Jamie, L. C., & Fong, L. H. (2017). Fundamental motor skill proficiency of 6-to 9-year-old Singaporean children. *Perceptual and Motor Skills, 124*(3), 584–600. https://doi.org/10.1177/0031512517703005

Nosek, B. A. (2005). Moderators of the relationship between implicit and explicit evaluation. *Journal of Experimental Psychology: General, 134*(4), 565. https://doi.org/10.1037/0096-3445.134.4.565

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math= male, me= female, therefore math≠ me. *Journal of Personality and Social Psychology, 83*(1), 44. https://doi.org/10.1037//0022-3514.83.1.44

Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2007). The implicit association test at age 7: A methodological and conceptual review. In J. A. Bargh (Ed.), *Automatic processes in social thinking and behavior* (pp. 265–292). New York, NY: Psychology Press.

O'brien, K. S., Puhl, R. M., Latner, J. D., Mir, A. S., & Hunter, J. A. (2010). Reducing anti-fat prejudice in preservice health students: A randomized trial. *Obesity, 18*(11), 2138–2144. https://doi.org/10.1038/oby.2010.79

O'Brien, W., Belton, S., & Issartel, J. (2016). Fundamental movement skill proficiency amongst adolescent youth. *Physical Education and Sport Pedagogy, 21*(6), 557–571.

Owen, M. B., Curry, W. B., Kerner, C., Newson, L., & Fairclough, S. J. (2017). The effectiveness of school-based physical activity interventions for adolescent girls: A systematic review and meta-analysis. *Preventive Medicine, 105*, 237–249. https://doi.org/10.1016/j.ypmed.2017.09.018

Paluck, E. L., & Green, D. P. (2009). Prejudice reduction: What works? A review and assessment of research and practice. *Annual Review of Psychology, 60*, 339–367. https://doi.org/10.1146/annurev.psych.60.110707.163607

Parri, M., & Ceciliani, A. (2019). Best practice in P.E. for gender equity-A review. *Journal of Physical Education and Sport, 19*, 1943–1952. https://doi.org/10.7752/jpes.2019.s5289

Pearson, N., Braithwaite, R., & Biddle, S. J. (2015). The effectiveness of interventions to increase physical activity among adolescent girls: A meta-analysis. *Academic Pediatrics, 15*(1), 9–18. https://doi.org/10.1016/j.acap.2014.08.009

Rauscher, L., & Cooky, C. (2016). Ready for anything the world gives her? : A critical look at sports-based positive youth development for girls. *Sex Roles, 74*, 288–298. https://doi.org/10.1007/s11199-014-0400-x

Ridgers, N. D., Salmon, J., Parrish, A.-M., Stanley, R. M., & Okely, A. D. (2012). Physical activity during school recess: A systematic review. *American Journal of Preventive Medicine, 43*(3), 320–328. https://doi.org/10.1016/j.amepre.2012.05.019

Sadker, D., & Sadker, M. (1985). Is the OK classroom OK? *Phi Delta Kappan, 66*(5), 358–361.

Sadker, M., & Sadker, D. (1986). Sexism in the classroom: From grade school to graduate school. *Phi Delta Kappan, 67*(7), 512–515.

Sadker, M., & Sadker, D. (1994). *Failing at fairness: How America's schools cheat girls*. New York, NY: MacMillan.

Schimmack, U. (2019). The implicit association test: A method in search of a construct. *Perspectives on Psychological Science, 16*(2), 396–414. https://doi.org/10.1177/1745691619863798

Spencer, R. A., Rehman, L., & Kirk, S. F. (2015). Understanding gender norms, nutrition, and physical activity in adolescent girls: A scoping review. *International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 6. https://doi.org/10.1186/s12966-015-0166-8

Tiedemann, J. (2000). Gender-related beliefs of teachers in elementary school mathematics. *Educational Studies in Mathematics, 41*(2), 191–207.

Valley, J. A., & Graber, K. C. (2017). Gender-biased communication in physical education. *Journal of Teaching in Physical Education, 36*(4), 498–509. https://doi.org/10.1123/jtpe.2016-0160

Vianello, M., & Bar-Anan, Y. (2020). Can the implicit association test measure automatic judgment? The validation continues. *Perspectives on Psychological Science, 16*(2), 415–421. https://doi.org/10.1177/1745691619897960

Watson, A., Eliott, J., & Mehta, K. (2015). Perceived barriers and facilitators to participation in physical activity during the school lunch break for girls aged 12–13 years. *European Physical Education Review, 21*(2), 257–271. https://doi.org/10.1177/1356336X14567545

Wellhousen, K., & Yin, Z. (1997). A study of equity in interactions between preservice teachers and their students. *Journal of Early Childhood Teacher Education, 18*(1), 5–10. https://doi.org/10.1080/10901029708549131

Wijayatunga, N. N., Kim, Y., Butsch, W. S., & Dhurandhar, E. J. (2019). The effects of a teaching intervention on weight bias among kinesiology undergraduate students. *International Journal of Obesity, 43*, 2273–2281. https://doi.org/10.1038/s41366-019-0325-0

Wright, J. (1996). Mapping the discourses of physical education: Articulating a female tradition. *Journal of Curriculum Studies, 28*(3), 331–351. https://doi.org/10.1080/0022027980280306

Wright, J. (1999). Changing gendered practices in physical education: Working with teachers. *European Physical Education Review, 5*(3), 181–197. https://doi.org/10.1177/1356336X990053002

Young, M. D., Lubans, D. R., Barnes, A. T., Eather, N., Pollock, E. R., & Morgan, P. J. (2019). Impact of a father–daughter physical activity program on girls' social–emotional well-being: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 87*(3), 294–307.

Younger, M., & Warrington, M. (2008). The gender agenda in primary teacher education in England: Fifteen lost years? *Journal of Education Policy, 23*(4), 429–445. https://doi.org/10.1080/02680930802054396