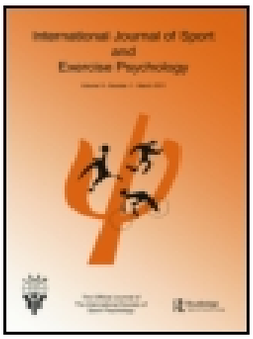

International Journal of Sport and Exercise Psychology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rijs20

Examining the importance of athletic mindset profiles for level of sport performance and coping

Dominic G. McNeil, Wendy J. Phillips & Sallie A. Scoggin

To cite this article: Dominic G. McNeil, Wendy J. Phillips & Sallie A. Scoggin (2023): Examining the importance of athletic mindset profiles for level of sport performance and coping, International Journal of Sport and Exercise Psychology, DOI: 10.1080/1612197X.2023.2180073

To link to this article: https://doi.org/10.1080/1612197X.2023.2180073

Published online: 22 Feb 2023.

INTERNATIONAL JOURNAL OF SPORT AND EXERCISE PSYCHOLOGY
https://doi.org/10.1080/1612197X.2023.2180073

Examining the importance of athletic mindset profiles for level of sport performance and coping

Dominic G. McNeil[a], Wendy J. Phillips[b] and Sallie A. Scoggin[b]

[a]Institute of Health and Wellbeing, Federation University Australia, Mt Helen, Australia; [b]School of Psychology, University of New England, Armidale, Australia

ABSTRACT

This study examined how growth and fixed mindset beliefs coexist within athletes to form distinct *Athletic Mindsets*; and whether these composite mindsets differentially predict level of sport performance and athletic coping skills. Athletes in Australia (N = 281, 52% male, M_{age} = 32.21, SD = 14.40) completed self-report questionnaires measuring mindset, athletic coping, and level of sport performance. Cluster analysis of growth and fixed belief variables identified four distinct athletic mindset profiles: High-Growth/Low-Fixed, Low Growth /Low Fixed, Low Growth /High Fixed, and High-Growth/High Fixed. Analysis revealed that athletes with a HighG/LowF mindset were more likely to participate at higher levels of sport performance than athletes with the other three mindsets, and that this predictive effect was mediated by greater athletic coping skills. These findings indicate that growth and fixed mindset beliefs coexist and interact, and that possessing a HighG/LowF mindset benefits sports performance and coping. These findings illustrate support for the use of athletic mindset profiles to predict level of sport performance and inform coaching strategies.

ARTICLE HISTORY
Received 8 September 2022
Accepted 26 January 2023

KEYWORDS
Athletic mindset profile; growth beliefs; fixed beliefs; athletic coping; level of sport performance

Mindset theory refers to a person's implicit beliefs about their own abilities to learn and improve, and this belief influences cognitions, emotions, and behaviour (Dweck & Leggett, 1988). Dweck (1986) argued that people think of human attributes as either immutable traits that we are born with and cannot be changed or malleable qualities that involve people being able to continually improve. These attributes have been constructed into two broad constructs of mindset theory: *growth mindset* that views ability as malleable and able to change with effort, learning, and feedback and *fixed mindset* that views ability as innate and stable over time regardless of external factors (Blackwell et al., 2007; Dweck, 2006). Individuals who report high levels of growth beliefs have been shown to embrace challenges, be highly motivated, be oriented towards improving their skills, devise mastery goals, self-regulate their behaviour, persevere in difficult situations, remain optimistic, and perceive feedback as an opportunity to improve (Blackwell et al., 2007; Chiu et al., 1997; Dweck & Leggett, 1988). Therefore, growth mindset's factors were the "learning" and "improvement" items about ability (Biddle et al., 2003). In contrast,

CONTACT Dominic G McNeil d.mcneil@federation.edu.au Institute of Health and Wellbeing, Federation University Australia, Mt Helen, Victoria 3357, Victoria, Australia

individuals who score highly on fixed beliefs regard their abilities as a gift or talent and may focus on outcome goals (e.g., attaining a certain score), with failure representing a threat to their self-esteem (Dweck & Leggett, 1988).

In many contexts, varying terms such as implicit beliefs, self-theories, implicit theories, entity and incremental beliefs, or growth mindset theories (Burnette et al., 2013; Gucciardi et al., 2015; Vella et al., 2016) have been used to explore the concept of mindset and implicit theory (for review, see Lüftenegger & Chen, 2017). Early research in the physical exercise domain focused on characterising motivation profiles in secondary students, and their associations with mindset beliefs, levels of physical activity, and goal orientation (Spray et al., 2006; Wang et al., 2002; Wang & Biddle, 2001). Within the sport domain, experimental studies showed that mindset beliefs of athletic ability could be manipulated in young student-athletes (Shaffer et al., 2015; Spray et al., 2006). Yet, while these few studies illustrate a foundation for mindset in sport, more empirical research with competitive athletes is needed.

More recently, theorists have argued that mindset beliefs have important implications for sport performance, emphasising the view that mindsets in high-performing athletes contribute to how they approach competitive situations and influence their sporting success (Dweck, 2017). Higher levels of growth beliefs may positively influence an athlete's interpretation of stressors (e.g., lessen the psychological impact of competitive anxiety) providing a psychological benefit for athletes and their performance (Jowett & Spray, 2013; Vella et al., 2014). Stenling et al. (2014) identified that a small negative correlation exists between growth mindset and anxiety in team sport athletes, and that those with a mastery-goal orientation group reported significantly less anxiety than the mastery-avoidance group. Whereas, Gardner et al. (2015) found a moderate, significant negative correlation between growth mindset and competitive anxiety, and a positive correlation between fixed mindset and competitive anxiety in elite soccer players. This evidence suggests that mindset may positively influence the athlete's interpretation of the stressor and lessen the psychological impact of competitive anxiety. Fundamentally, mindsets predict the way in which individuals interpret situations and self-regulate, which is consequential for performance (Burnette et al., 2013).

This perspective has gained some empirical support. For example, a meta-analysis of 39 studies by Vella et al. (2016) found that adaptive physical activity outcomes (e.g., mastery climate, perceived competence, performance) were positively associated with high levels of growth beliefs (as a separate variable), and negatively associated with low levels of fixed beliefs. Additionally, fixed beliefs were, on average, associated with higher levels of maladaptive physical activity outcomes. Yet, as most of the studies reviewed by Vella et al. (2016) focused on physical activity or physical education in university or school populations, it is not known whether similar findings apply to sports or athletic performance in competitive contexts. Athletes may experience different competitive stressors due to a variety of mechanisms within sport, either before and/or during competition (Ford et al., 2017; Martens et al., 1990). It is important to recognise factors that contribute to handling the competitive stressors as athletes who cannot cope may suffer psychologically, experience burnout, or career loss by dropping out (Gardner et al., 2015; Gustafsson et al., 2017).

Most of the research to date has tended to examine fixed and growth beliefs as independent predictors of sports outcomes. This approach is supported by factor-analytical

studies that have determined that fixed and growth beliefs are relatively independent constructs (Karwowski et al., 2019). Yet statistical independence of the two mindset beliefs also makes it possible for them to coexist in many combinations within individuals; a possibility that is consistent with Dweck et al. (1995) suggestion that individuals may possess both mindset beliefs to varying degrees. Theorists argue that while one belief may be the more dominant and the individual has stronger links to its structural outcomes, the other may still be available and may become accessible under particular circumstances (Lüftenegger & Chen, 2017). Accordingly, person-centred analyses have demonstrated that individuals simultaneously possess both fixed and growth beliefs (Chen & Tutwiler, 2017; Karwowski et al., 2019). Karwowski et al. (2019), for example, used latent profile analysis to examine the role of fixed and growth mindset beliefs in the creativity of tertiary students. Their work identified four distinct clusters of students who reported: (1) high levels of growth and fixed beliefs, (2) high-growth and low-fixed beliefs, (3) low growth and high fixed beliefs, and (4) low levels of growth and fixed beliefs. Importantly, specific clusters were associated with different psychological profiles. Individuals with a high-growth and low-fixed belief profile were consistently highest in creative potential, activity, achievement, and self-concept (Karwowski et al., 2019). Whereas individuals with high-growth beliefs coupled with high fixed beliefs reported lower levels of potential, activity, and achievement than the high-growth/low-fixed group; indicating that the two types of beliefs interact within individuals to produce distinct outcomes.

The advantage of person-centred analyses like latent profile analysis or cluster analysis is that they mimic higher-order interactions (Lanza et al., 2010; Merz & Roesch, 2011), while also exploring how traits are organised within individuals (Merz & Roesch, 2011). Consequently, person-centred analyses can provide considerable conceptual advances to understanding mindset theory. However, although researchers have theorised that fixed and growth mindset beliefs coexist within athletes (Slater et al., 2012), limited research has incorporated this empirical approach. Wang and Biddle (2001) discovered motivational profiles interacted differently with combinations of mindset beliefs. Whereas Gucciardi et al. (2015) found two different profiles of mindset beliefs, a high-growth (incremental)/low-fixed (entity) group and an ambivalent mindset group; however, both groups indicated moderate scores for mental toughness in adolescent athletes. Consequently, it is important to understand how fixed and growth beliefs combine within individuals to form *Athletic Mindsets*, and examine if these composite mindsets predict sporting performance and sport-related psychological variables such as coping.

Coping is critical for determining athletic performance, as it represents the capacity to change cognitions and behaviour in response to varying demands (Hill & Hemmings, 2015; Nicholls & Polman, 2007). Coping refers to an athlete's self-regulatory processes, and may include affective, cognitive, and behavioural strategies to manage the stresses of competition (Crocker et al., 2015). Athletes need to handle the negative outcomes of stress or anxiety experienced in situations where they perceive the competitive situations as threatening (Schaefer et al., 2016); thus, the ability of athletes to handle the stressors and demands of competition, at all levels of sport, frequently separates the winners from the losers (Galli & Gonzalez, 2015). It is, therefore, not surprising that coping is a reliable predictor of level of sport performance, with a meta-analysis revealing a moderately strong mean association between mastery coping (controlling the situation and

eliminating stressors) and successful performance in a large, pooled sample of individual, team, and mixed sport athletes (Nicholls et al., 2016). Furthermore, coping skills have been found to explain unique variance in sports performance after statistically controlling for physical and technical skills (Christensen & Smith, 2018), and they are known to mediate relationships between other sports-related psychological variables (e.g., competitive anxiety, perceived coaching) and outcomes (e.g., sports commitment, sports achievement) (Nicholls et al., 2010; Nicolas et al., 2010; Pons et al., 2018).

The existing literature suggests that athletic coping skills may play a similar mediating role in the relationship between *Athletic Mindsets* and level of sport performance. Dweck and Leggett (1988) found that fixed and growth mindset beliefs were associated with different coping mechanisms to handle stressful situations. That is, when faced with failure, individuals with high levels of fixed beliefs responded to challenge with helplessness (i.e., avoidance orientation coping), whereas individuals with high levels of growth beliefs engaged in coping behaviours that improved performance despite obstacles (i.e., mastery-oriented coping) (Dweck & Leggett, 1988). When they failed at a task, those with high-growth beliefs increased their effort, maintained positive self-talk and mastered the task; in contrast, those with high fixed beliefs demonstrated helplessness, negative self-talk, and task aversion, associated with performance anxiety (Dweck & Leggett, 1988).

This study extends previous mindset literature by examining how growth and fixed beliefs tend to coexist and combine within competitive athletes to form distinct *Athletic Mindsets;* and determining whether these composite mindsets differentially predict level of sport performance and athletic coping skills. Theory and evidence suggest that possessing growth beliefs may be associated with the protective attributes of coping, whereas high levels of fixed beliefs may be associated with maladaptive coping (i.e., fear of failure and/or negativity). Yet, research investigating associations between mindset beliefs and level of sport performance amongst athletes is lacking, along with knowledge of mechanisms underlying these potential associations. Consequently, this study used a sample of athletes to answer four primary research questions.

First, we aimed to identify *Athletic Mindsets* that incorporate distinct combinations of growth and fixed beliefs. In line with theory (Dweck et al., 1995) and previous research (Karwowski et al., 2019), we hypothesised that a cluster analysis would identify four athletic mindsets: (1) high-growth and low-fixed beliefs (HighG/LowF), (2) high-growth and high fixed beliefs (HighG/HighF), (3) low growth and low-fixed beliefs (LowG/LowF), and (4) low growth and high fixed beliefs (LowG/HighF). Second, we aimed to determine whether athletic mindsets were associated with level of sport performance and athletic coping skills amongst competitive sportspeople. Given previous evidence, we hypothesised that individuals who possessed a HighG/LowF mindset would report higher levels of sport performance and greater coping skills than the other three hypothesised athletic mindsets. Third, we aimed to explore whether Athletic Mindsets explain more variance in performance than the two mindset variables as individual predictors. Fourth, we aimed to determine whether athletic coping skills mediated the association between athletic mindset and sports performance. We hypothesised that, compared to the other three mindsets, membership of the HighG/LowF profile would exhibit an indirect association with higher levels of sport performance via higher levels of athletic coping skills.

Method

Participants

Participants were required to be self-classified as athletes participating in competitive sports and at least 16 years of age. Two-hundred and eighty-one athletes (52.0% male) completed the survey from an Australian sample, with ages ranging from 16 to 73 years ($M = 32.21$, SD = 14.40).

Participants had engaged in sport for an average of 11.84 years (SD = 10.20) and the highest levels of competition they achieved were Recreational ($n = 85$; 30.2%), Regional ($n = 38$, 13.5%), State ($n = 39$, 13.9%), National ($n = 70$, 24.9%), or International ($n = 49$, 17.4%). Participants indicated they competed in a variety of sports, which we classified into six categories. The majority of participants were classified as performing in *Games* ($n = 95$, 33.8%). This classification represented athletes who competed in sports such as soccer, cricket, netball, Australian football, basketball, and hockey. The next largest category was *Outdoor Pursuits* ($n = 89$, 27.8%), which represented athletes who participated in sports such as mountain biking, rowing, sailing, road cycling. *Athletics* ($n = 72$, 29.5%) also had a large representation, with participants involved in athletic events such as track and field, long-distance running, and triathlon. Other categories were: *Gymnastics* ($n = 15$, 5.3%) involved in gymnastic competitions, *Dance* ($n = 1$, 0.4%), involved in competitive dancing, and *Combat and Target Sports* ($n = 9$, 3.2%), which included competing in taekwondo, boxing, and fencing. Participants were not asked to identify whether their involvement in sport represented primarily individual or team-based activity.

Materials

Level of sport performance

In this study, we operationalised level of sport performance as the highest level of sporting participation reached by an athlete. Participants were required to indicate their highest level of participation from the options: (1) Recreational, (2) Regional, (3) State, (4) National, or (5) International.

Growth and fixed mindset beliefs

The 12-item Conceptions of the Nature of Athletic Ability Questionnaire-2 (CNAAQ-2; Biddle et al., 2003) was used to assess fixed and growth beliefs related to athletic or sport ability. Participants responded to 6 items that assessed their growth beliefs (e.g., "you need to learn and work hard to be good at sport") and 6 items that assessed their fixed mindset (e.g., "we have a certain level of ability in sport and we cannot really do much to change that level"), by indicating their agreement on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Fixed and growth scores were calculated by summing across the respective subscale items, with higher scores denoting higher beliefs in that subscale. In the current sample, internal consistency was acceptable for growth ($\alpha = .74$) and fixed ($\alpha = .76$).

Athletic coping

The Athletic Coping Skills Inventory-28 (ACSI-28; Smith et al., 1995) measured personal coping resources. The scale's 28 items present statements that may describe how

individuals cope in sporting situations (e.g., I maintain emotional control no matter how things are going for me; "I handle unexpected situations in my sport very well"). Participants indicated how often each statement applies to them on a 4-point Likert scale ranging from 0 (*almost never*) to 3 (*almost always*). Item scores were summed to create total scores, with higher scores denoting greater coping resources. Cronbach's alpha was good in the current sample ($\alpha = .87$).

Procedure

The study commenced with Human Research Ethics Committee approval. Several Australian sporting organisations advertised the project to their affiliated athletes, who were Australian residents aged 16 or older, to participate in the study. The advertisements were distributed by email, social media, or website announcement, and included a link to the study's Qualtrics survey. All respondents were provided with an information sheet about the purpose of the study and key ethical information including that the survey involved anonymous participation and participants could withdraw from the study by closing the survey link at any point. After providing informed consent, they answered questions to determine whether they met the study's inclusion criteria. Respondents who were underage the eligibility cut off, refused consent, or were not Australian residents were taken to the end of the survey. Participants then answered further demographic questions, followed by measures that assessed their main sporting type, highest level of participation, growth mindset beliefs, fixed mindset beliefs, and athletic coping.[1] The study measures were presented in randomised order across participants. The opportunity to win one of five $50 gift cards from a sports retailer was an incentive to participate. De-identifiable data available on request.

Statistical methods

Using SPSS-25 (IBM Corp., 2017), we identified *Athletic Mindsets* in the sample by conducting a cluster analysis that classified participants into groups according to their standardised scores on the growth and fixed subscales of the CNAAQ-2. Subsequent ANOVAs and Chi-square tests determined characteristics of the emergent athletic mindsets, and an ANCOVA assessed the relationship between Athletic Mindsets and sports performance. A multiple regression evaluated the growth and fixed mindset variables as individual predictors of sports performance, and a correlation comparison test (Lee & Preacher, 2013) assessed the difference between the relationships between Athletic Mindsets and performance vs the two individual mindset beliefs and performance. We then used PROCESS (Hayes, 2017) to conduct a mediation analysis that examined a potential indirect path between membership of the athletic mindsets (as a categorical variable) and sport performance via athletic coping.

To achieve normality of the regression residuals, square root transformations were applied to the growth mindset and sports performance variables. The homogeneity of variance assumption was violated for the ANOVAs that compared fixed beliefs and growth beliefs, so we used the robust Welch's Test for these analyses. Ten multivariate outliers were found in the dataset (including eight fencers), but their exclusion did not

change the results of any of the analyses, so they were retained. There were no missing values and all other assumptions of the analyses were met.

Results

Descriptive information

Sample means, correlations, and a chi square test are displayed in Table 1. The bivariate correlations indicated that sport performance was weakly related to coping and the fixed and growth mindset variables. However, age and years in sport were significantly correlated with sport performance, and a chi square test indicated that type of sport was also related to performance, $\chi^2(20) = 111.96$, $p < .001$, so we included these three variables as covariates in the planned analyses to control for their confounding effects. Sporting type was represented by a set of dummy variables with Games (the most frequently reported sport) as the comparison category.

Cluster analysis

We subjected the growth and fixed belief variables to a log-likelihood two-step cluster analysis based on Schwarz's Bayesian Information Criterion, with the aim of identifying a satisfactory 4-cluster solution that represented the four theoretically possible combinations of growth and fixed beliefs (HighG/LowF, HighG/HighF, LowG/LowF, and LowG/HighF). These 4-clusters of participants were identified in the dataset, as indicated by mean belief scores that were significantly above (High) or below (Low) the sample mean. Importantly, the cluster solution also exhibited a good silhouette measure of cohesion and separation, and each of the four clusters comprised similar proportions of the sample (see Figure 1). The solution was, therefore, highly interpretable and suitable for addressing our research questions. To ensure the validity of our approach, we compared the 4-cluster solution with solutions ranging from 1- to 6-clusters. In all cases, the 4-cluster solution provided a better fit to the data.

Differences between the athletic mindset clusters on growth and fixed belief means are reported in Table 2, which also presents the results of ANOVAs and chi square tests that examined differences between the athletic mindsets on demographic variables. Female athletes were statistically overrepresented in the LowG/LowF mindset group, but the four mindset clusters did not differ on age, years in sport, or type of sport.

Athletic mindsets versus separate mindset variables

As hypothesised, the ANCOVA reported in Table 2 revealed a significant positive relationship between the Athletic Mindsets and level of sport performance after controlling for the three covariates ($\eta^2 = .03$, $r = .17$, $p = .04$). Planned Helmert contrasts indicated that the HighG/LowF group reported higher mean sports performance than the other three groups.

A multiple regression then assessed the two mindset variables as individual predictors of level of sport performance. The three covariates were entered at the first step, and the growth and fixed mindset variables were entered at the second step. The model

Table 1. Correlations, means, and standard deviations: study variables and potential covariates.

Variables	Gender	Age	Years in sport	Athletic coping	Fixed mindset	Growth mindset	Sports performance
Age	.05						
Years in sport	−.15*	.37***					
Athletic coping	−.05	.10	.11				
Fixed mindset	−.13*	.05	.06	−.16**			
Growth mindset	−.02	−.03	−.02	.24**	−.29***		
Sports performance	−.12	−.30***	.12*	.11	−.02	.06	
Mean (SD)	1.48 (0.50)	32.21 (14.40)	11.84 (10.20)	13.91 (3.98)	25.88 (3.24)	53.17 (11.30)	2.86 (1.51)

Notes: $N = 281$. Gender, Male = 1, Female = 2. Type of sport was significantly related to sports performance, $\chi^2(20) = 112.43$, $p < .001$.
***$p < .001$.
**$p < .01$.
*$p < .05$.

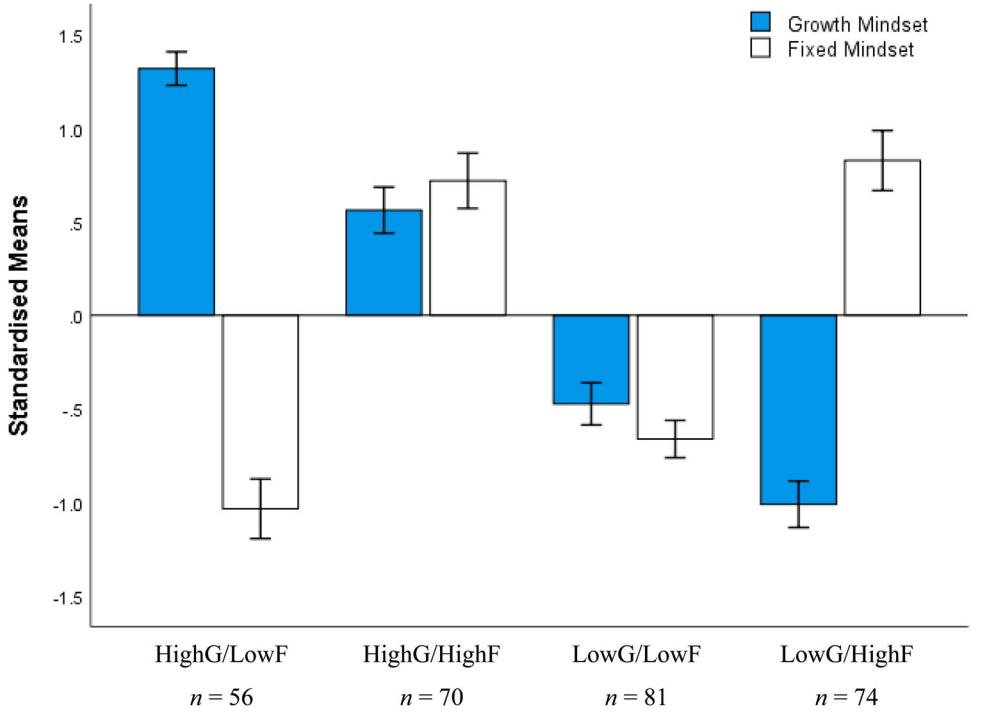

Figure 1. Athletic mindsets by cluster. $N = 281$. Standardised means are depicted. Error bars: 95% CI.

explained 24.4% of the variance in the level of sport performance, $F(8,272) = 10.62$, $p < .001$. After controlling for the three covariates, the two mindset variables explained 0.03% ($r = .05$, $p = .58$) of the variance in level of sport performance, with weak relationships evident for both mindset variables (Growth, $\beta = .06$, $p = .31$; Fixed, $\beta = .001$, $p = .99$).

As expected, ANCOVA identified that the Athletic Mindset membership and the Fixed and Growth mindset variables shared substantial variance after controlling for the three covariates ($\eta^2 = .68$, $r = .82$, $p < .001$). A correlation comparison test (Lee & Preacher, 2013) that controlled for the shared variance indicated that the relationship between Athletic Mindsets and level of sport performance ($r = .17$) was significantly stronger than the relationship between the two mindset variables and level of sport performance ($r = .05$), $z = 3.37$, $p < .001$.

Mediation analysis

To address our mediation hypothesis, we instructed PROCESS to create dummy variables using Helmert coding. The first dummy variable (D1) compared the HighG/LowF group (negatively coded) with the mean performance scores of the other three groups (positively coded). The D1 variable therefore assessed the hypothesis that HighG/LowF would be associated with optimal sports-related outcomes. The second dummy variable (D2) compared the HighG/HighF (negatively coded) with the LowG/LowF and LowG/HighF groups (positively coded), and the third dummy variable (D3) compared the LowG/LowF (negatively coded) and LowG/HighF groups (positively coded). Age, years

Table 2. Characteristics of the athletic mindsets.

Variables	HighG/LowF ($n = 56$)		HighG/HighF ($n = 70$)		LowG/LowF ($n = 81$)		LowG/HighF ($n = 74$)		Group Differences	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*F*	η^2
Fixed beliefs$^{o\wedge}$	9.79^{a}	2.37	16.77^{c}	2.47	11.27^{b}	1.80	17.20^{c}	3.98	172.96***	.65
Growth beliefs$^{o\wedge}$	29.43^{d}	0.65	27.90^{c}	1.26	24.65^{b}	2.03	22.49^{a}	2.45	297.15***	.76
Age^{o}	32.09^{a}	13.08	32.46^{b}	14.88	31.15^{c}	15.03	33.23^{a}	14.39	0.28	.00
Years in sport^{o}	11.39	8.99	11.63	10.16	10.82	10.42	13.49	10.84	0.16	.00
Athletic coping$^{+\wedge}$	58.66^{a}	12.35	52.87^{b}	11.62	52.38^{b}	11.53	50.15^{b}	8.26	7.47***	.08
Sports performance^{+}	3.25^{a}	1.47	2.91^{b}	1.56	2.59^{b}	1.55	2.80^{b}	1.41	2.72*	.08
	%	Z_{Resid}	%	Z_{Resid}	%	Z_{Resid}	%	Z_{Resid}	χ^2 (df)	
Gender									χ^2 (3) = 7.95*	
Male	48.2	−0.6	58.6	1.3	40.7	**−2.4**	60.8	1.8		
Female	51.8	0.6	41.4	−1.3	59.3	**2.4**	39.2	−1.8		
Sport Types									χ^2 (15) = 11.01	
Games	25.0	−1.6	37.1	0.7	33.3	−0.1	37.8	0.9		
Athletics	25.0	−0.1	20.0	−1.2	28.4	0.7	28.4	0.6		
Gymnastics	5.4	0.0	4.3	−0.5	4.9	−0.2	6.8	0.6		
Outdoor pursuits	42.9	**2.0**	32.9	0.2	29.6	−0.5	24.3	−1.6		
Dance	0.0	−0.5	1.4	1.7	0.0	−0.6	0.0	−0.6		
Combat & target	1.8	−0.7	4.3	0.6	3.7	0.3	2.7	−0.3		

Notes: ($N = 281$). ^{o}ANOVA where group means with different superscripts (in rows) are significantly different at $p < .05$ (Bonferroni). +ANCOVA with planned Helmert contrasts with HighG/LowF as the comparison group, controlling for age, years in sport, and sport type. Z_{Resid} = Adjusted standardised residual, where Z_{Resid} +/− 2 is significant at $p < .05$ as highlighted in bold. ^Welch's statistic is reported. ***$p < .001$, *$p < .05$.

in sport, and type of sport were entered as covariates. We reran the model using standardised variables to obtain standardised betas for the *a* and *b* paths.

As shown in Figure 2 and Table 3, the mediation model positioned athletic coping skills (ACSI-28 total score) as a mediator of the association between athletic mindset and level of sport performance. The total effect model was significant, $F(9,271) = 10.43$, $p < .001$, and revealed a significant negative relative total effect of D1 ($B = -0.14$, 95% CI −0.26 to −.01) which indicated that members of the HighG/LowF group tended to perform at a higher level of sport performance than did members of the other three mindset groups, after controlling for age, years in sport, and type of sport. Additionally, non-significant relative total effects for D2 ($B = -0.08$, 95% CI −0.20–0.04) and D3 ($B = .09$, 95% CI −0.05–0.22) indicated that members of the HighG/HighF, LowG/LowF, and LowG/HighF groups reported similar levels of sport performance.

Athletic mindset membership and the three covariates explained a significant 10.0% of the variance in coping ($p < .001$), and the overall model explained 26.9% of the variance in level of sport performance. As hypothesised, the path from D1 to athletic coping was negative and significant, indicating that, relative to the HighG/LowF group, participants in the other three mindset groups tended to report lower levels of athletic coping skills. Additionally, non-significant paths from D2 and D3 to athletic coping indicated that participants classified as HighG/HighF, LowG/LowF, or LowG/HighF reported similar levels of coping.

The path from athletic coping to level of sport performance was positive and significant, indicating that individuals who reported greater coping skills also tended to report higher levels of sport performance. Consequently, as hypothesised, the relative indirect effect of athletic mindset on level of sport performance through athletic coping was significant. Members of the HighG/LowF group tended to report higher levels of athletic coping skills than did the other three mindsets which, in turn, were associated with relatively higher levels of sport performance ($B = -0.03$, 95% CI −.08 to −0.00). The relative direct effect of D1 on level of sport performance was non-significant

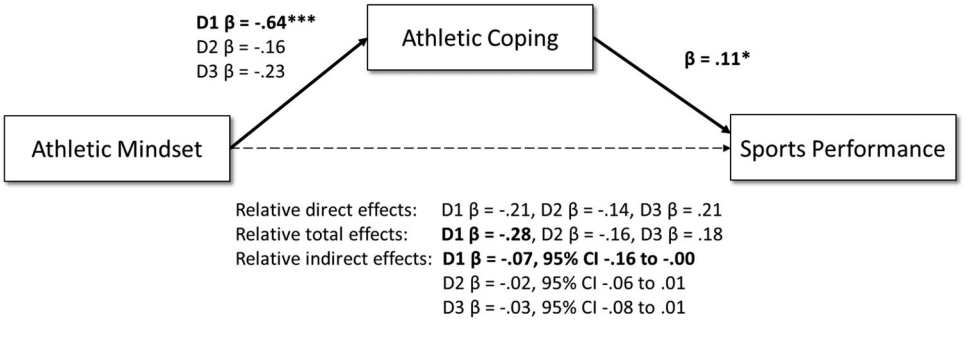

Figure 2. Mediation model examining the indirect effects of athletic mindset on sports performance level through athletic coping.

Notes: $N = 281$. Athletic mindset includes three Helmert coded dummy variables: D1 = difference between HighG/LowF (negatively coded) and the other three groups (positively coded); D2 = difference between HighG/HighF (negatively coded) and LowG/LowF and LowG/HighF groups (positively coded); D3 = difference between LowG/LowF (negatively coded) and LowG/HighF groups (positively coded). The model controlled for the effects of age, years in sport, and type of sport. Solid lines and bolded coefficients indicate significant paths. Standardised effects are reported. ***$p < .001$, *$p = .05$.

Table 3. Mediated regression analysis predicting sports performance via athletic coping.

	Athletic coping skills					Sports performance				
Predictor	*B*	SE	*p*	LLCI	ULCI	*B*	SE	*p*	LLCI	ULCI
D1	**−7.18**	**1.65**	**<.001**	**−10.42**	**−3.94**	−0.10	0.07	.12	−0.23	0.03
D2	−1.81	1.58	.25	−4.92	1.29	−0.07	0.06	.25	−0.19	0.05
D3	−2.64	1.76	.14	−6.12	0.83	0.10	0.07	.15	−0.04	0.23
Age	0.07	0.06	.24	−0.05	0.18	**−0.02**	**0.00**	**<.001**	**−0.02**	**−0.01**
Years	0.09	0.07	.22	−0.05	0.23	**0.02**	**0.00**	**<.001**	**0.01**	**0.02**
Athletics	1.52	1.82	.40	−2.07	5.11	**0.20**	**0.07**	**.004**	**0.07**	**0.34**
Gymnastics	−2.62	3.04	.39	−8.61	3.37	**0.38**	**0.12**	**.001**	**0.15**	**0.61**
Outdoor	−1.67	1.85	.37	−5.31	1.96	**0.25**	**0.07**	**.001**	**0.12**	**0.39**
Combat	0.61	3.81	.87	−6.88	8.11	**0.61**	**0.15**	**<.001**	**0.32**	**0.90**
Coping						**0.01**	**0.00**	**.04**	**0.00**	**0.01**
Model $F(9, 271) = 3.36$, $R^2 = .10$, $p < .001$						$F(10, 270) = 9.91$, $R^2 = .27$, $p < .001$				

Notes: $N = 281$. D1 = difference between HighG/LowF (negatively coded) and the other three groups (coded positively); D2 = difference between HighG/HighF (negatively coded) and LowG/LowF and LowG/HighF groups (positively coded); D3 = difference between LowG/LowF (negatively coded) and LowG/HighF groups (positively coded); Sporting types = sport compared to Games; Unstandardised effects are reported. 95% CI. Significant difference are represented in bold.

($B = -.10$, 95% CI −0.23–0.03), indicating that athletic coping fully mediated the association. The relative indirect effects of D2 and D3 were not significant (both $B = -.01$, 95% CIs −0.03 to .01 and −.04 to .00, respectively).

Discussion

Research on mindset theory (Dweck & Leggett, 1988) in the context of sport and physical activity has predominantly compared growth and fixed mindset beliefs as independent predictors of key performance or psychological characteristics (e.g., Gardner et al., 2015; Stenling et al., 2014; Vella et al., 2016). This study extended previous mindset literature by investigating whether growth and fixed beliefs coexist to form distinct athletic mindsets in a sample of athletes. As hypothesised, a cluster analysis of participants' scores on the fixed and growth mindset subscales of the CNAAQ-2 (Biddle et al., 2003) identified four groups of athletes that exhibited distinct mindset profiles: HighG/LowF, LowG/LowF, LowG/HighF, and HighG/HighF. These profiles confirmed the hypothesised interaction between growth and fixed mindset beliefs in sport (Slater et al., 2012), and resemble profiles found by Karwowski et al. (2019) in a student sample. Therefore, rather than having a dichotomous preference (i.e., growth or fixed) as previously suggested by some theorists (Blackwell et al., 2007; Dweck, 2006), the current results support theorists' (e.g., 1995; Lüftenegger & Chen, 2017) suggestion that athletes' mindsets can involve an interaction between growth and fixed beliefs. Subsequent analyses determined that the composite mindsets were associated with sporting performance and athletic coping.

Based on theoretical recommendations and previous research (Dweck et al., 1995; Karwowski et al., 2019; Slater et al., 2012), we anticipated that having a HighG/LowF mindset would confer performance and psychological benefits to athletes. As hypothesised, an ANCOVA found that athletes with a HighG/LowF mindset were more likely to compete at high sporting levels than athletes with a LowG/LowF, LowG/HighF, or HighG/HighF mindset (after controlling for age, years in sport, and type of sport). Differences found between mindset groups are similar to previous research that found composite mindset groups differed on psychological variables (e.g., Gucciardi et al., 2015; Wang &

Biddle, 2001). This finding is remarkable, however, because neither growth nor fixed mindset beliefs were independently associated with sports performance in the current sample. Indeed, a correlation comparison test revealed that the relationship between Athletic Mindset and level of sport performance was significantly stronger than the relationship between the two mindset beliefs (as individual variables assessed simultaneously) on level of sport performance. This finding demonstrates that the nuance exhibited by the Athletic Mindset provided an advantage when exploring mindset beliefs as independent constructs, supporting future adoption of the person-centred analytic approach to better understand important variances to athlete's psychological profile.

Subsequent mediated multiple regression analysis found that the association between Athletic Mindset and level of sport performance was explained by greater athletic coping skills. Level of sport performance and athletic coping skills did not differ across LowG/LowF, LowG/HighF, and HighG/HighF athletic mindsets. The finding that members of the LowG/LowF and LowG/HighF mindsets achieved relatively low sporting and coping levels is consistent with previous research suggesting that low levels of growth beliefs may inhibit an athlete's development (Christensen & Smith, 2018). Possessing few growth beliefs has been associated with low levels of adaptive characteristics, such as perceived competence, enjoyment, mastery climate, and intrinsic motivation (Vella et al., 2016), and with fewer coping mechanisms that involve positively appraising and responding to challenges (Dweck & Leggett, 1988). Without these attributes, athletes may not have sufficient motivational drive or orientation towards improvement to attain high level competition (Biddle et al., 2003; Blackwell et al., 2007). These shortcomings may be exacerbated by the simultaneous possession of abundant fixed beliefs by the LowG/HighF group, which have been associated with motivational deficits and maladaptive characteristics such as ego orientation, a performance climate, and helplessness (Dweck & Leggett, 1988; Vella et al., 2016). Alternatively, whilst speculative, sport coaches may not see value or potential in athletes who display low growth characteristics and may not provide developmental opportunities or coaching engagement that could lead to sporting competition opportunities. Greater research is needed to examine whether mindset profiles influence transitional opportunities for developing athletes.

Of particular interest, the HighG/HighF group reported similarly lower mean levels of sporting performance and athletic coping skills to the LowG/HighF and LowG/LowF mindset groups after controlling for age, years in sport, and type of sport. This finding suggests that possessing relatively high levels of growth beliefs may not confer a competitive advantage when they are accompanied by high levels of fixed beliefs. Thus, it is possible that abundant growth beliefs may not effectively override the adverse effects of high levels of fixed beliefs on performance and coping. While not focused on sport, this finding is similar to Karwowski et al. (2019), who found that high-growth beliefs coupled with high fixed beliefs reduced creativity in tertiary students. However, although levels of growth beliefs reported by the HighG/HighF group were higher than the two LowG group means and the sample average, it should be noted that they were significantly lower than levels reported by the HighG/LowF group. It is therefore possible that enhanced performance and coping by the HighG/LowFgroup may reflect a threshold of growth beliefs that must be reached before they confer benefits in a sporting context. Further research is needed to evaluate these possibilities – that is, to determine if growth beliefs can override the limiting effects of fixed beliefs on other sports-

related goals and psychological outcomes, and/or whether a specific threshold of growth beliefs is required to manifest in a competitive advantage. This knowledge may inform approaches to coaching and training strategies.

Limitations and future directions

Several limitations of the current study should be considered when interpreting the results. We examined a broad sample of athletes from several sports, yet as the data was collected via self-report measures, it may be vulnerable to bias (Meltzoff & Cooper, 2018). Given that participants self-selected level of performance, and that there was no objective measure of their status, there is a possibility that these participants exaggerated their capacity as advanced sporting performers. Our results may therefore differ in important ways from samples that are drawn from different populations, such as from specific sports, levels, or venues. For example, Sigmundsson et al. (2020) illustrated that correlations between mindset and another psychological variable (grit) differed between football players of different skill levels; and Vella et al. (2016) meta-analytically observed a moderate positive bivariate association between growth beliefs and performance across university and school samples, which contrasts with the weak correlation found in our athlete sample. These sample differences may extend to the structure and/or predictive strength of mindset profiles that exist within them. Further research is, therefore, needed to determine whether our findings generalise to other specific and broad athlete samples, particularly when they can be objectively categorised.

It is also important to note that the cross-sectional nature of the current study prevents the drawing of causal inferences. A future longitudinal study may more closely estimate the observed indirect pathway. Longitudinal research could also determine whether certain sporting situations (i.e., performance across a season) or differing sport contexts (i.e., rivalry match, grand final) impacts the stability of the mindset profiles. An alternative avenue of exploration is through the conduction of experimental studies that manipulate mindset beliefs to address questions of causation. For example, researchers could try to prime different sporting contexts (i.e., through video, text, or imagery script) to examine cognitive, emotional or behavioural responses associated with the different mindset profiles, or incorporate mindset training to determine whether responses mirror mindset characteristics. This would build on previous research that has identified that mindset beliefs of athletic ability could be manipulated in young student-athletes (Shaffer et al., 2015; Spray et al., 2006). Qualitative analysis could be utilised to further understand and explore the contribution of mindset to athletes. This approach would help recognise and develop the role of the athlete's mindset in attaining sporting achievements, while also developing a better understanding of the connection between mindset to other key psychological characteristics important in sport.

Conclusion

Using a diverse cross-sectional sample of athletes in Australia, the results of this study provide support for the notion that *Athletic Mindset* profiles containing growth and fixed beliefs exist, and that they may offer greater predictive utility than beliefs assessed as separate independent variables. After controlling for age, years in sport, and type of

sport, possessing a HighG/LowF mindset was directly associated with higher levels of sport performance and greater athletic coping skills than possessing a HighG/HighF, LowG/LowF, or LowG/HighF mindset. Consequently, there may be significant contributions that a HighG/LowF mindset may provide to other important sports-related psychological outcomes. Thus, our results suggest that strategies designed to simultaneously increase growth beliefs and decrease fixed beliefs may be a productive addition to coaching programs. Future sports-based mindset research may therefore benefit from using person-centred approaches to examine the conceptual and practical importance of mindsets.

Note

1. Participants also completed measures of resilience, mental toughness, and competitive anxiety for other research studies. Due to the established literature on mindset, the focus and complexity of the data analysis and explorative analysis identifying some collinearity issues between the measures of the psychological variables, it was decided to focus on the main variables of the study as mentioned in the method section. Presentation of all measures was randomised across participants.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Biddle, S. J., Wang, C. J., Chatzisarantis, N. L., & Spray, C. M. (2003). Motivation for physical activity in young people: Entity and incremental beliefs about athletic ability. *Journal of Sports Science*, *21* (12), 973–989. https://doi.org/10.1080/0264041031000164137

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, *78*(1), 246–263. https://doi.org/10.1111/j.1467-8624.2007.00995.x

Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, *139*(3), 655–701. https://doi.org/10.1037/a0029531

Chen, J. A., & Tutwiler, M. S. (2017). Implicit theories of ability and self-efficacy: Testing alternative social cognitive models of science motivation. *Zeitschrift für Psychologie*, *225*(2), 127–136. https://doi.org/10.1027/2151-2604/a000289

Chiu, C.-y., Hong, Y.-y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of Personality and Social Psychology*, *73*(1), 19–30. https://doi.org/10.1037/0022-3514.73.1.19

Christensen, D. S., & Smith, R. E. (2018). Leveling the playing field: Can psychological coping resources reduce the influence of physical and technical skills on athletic performance? *Anxiety, Stress, & Coping*, *31*(6), 626–638. https://doi.org/10.1080/10615806.2018.1506646

Crocker, P. R., Tamminen, K. A., & Gaudreau, P. (2015). *Coping in sport. Contemporary advances in sport psychology: A review*. Routledge.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, *41*(10), 1040–1048. https://doi.org/10.1037/0003-066X.41.10.1040

Dweck, C. S. (2006). *Mindset: How you can fulfil your potential*. Robinson.

Dweck, C. S. (2017). *Mindset: Changing the way you think to fulfil your potential*. Hachette.

Dweck, C. S., Chiu, C. Y., & Hong, Y. Y. (1995). Implicit theories: Elaboration and extension of the model. *Psychological Inquiry*, *6*(4), 322–333. https://doi.org/10.1207/s15327965pli0604_12

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256–273. https://doi.org/10.1037/0033-295X.95.2.256

Ford, J. L., Ildefonso, K., Jones, M. L., & Arvinen-Barrow, M. (2017). Sport-related anxiety: Current insights. *Open Access Journal of Sports Medicine*, *8*, 205–212. https://doi.org/10.2147/OAJSM.S125845

Galli, N., & Gonzalez, S. P. (2015). Psychological resilience in sport: A review of the literature and implications for research and practice. *International Journal of Sport and Exercise Psychology*, *13*(3), 243–257. https://doi.org/10.1080/1612197X.2014.946947

Gardner, L. A., Vella, S. A., & Magee, C. A. (2015). The relationship between implicit beliefs, anxiety, and attributional style in high-level soccer players. *Journal of Applied Sport Psychology*, *27*(4), 398–411. https://doi.org/10.1080/10413200.2015.1019681

Gucciardi, D. F., Hanton, S., Gordon, S., Mallett, C. J., & Temby, P. (2015). The concept of mental toughness: Tests of dimensionality, nomological network, and traitness. *Journal of Personality*, *83*(1), 26–44. https://doi.org/10.1111/jopy.12079

Gustafsson, H., Sagar, S., & Stenling, A. (2017). Fear of failure, psychological stress, and burnout among adolescent athletes competing in high level sport. *Scandinavian Journal of Medicine & Science in Sports*, *27*(12), 2091–2102. https://doi.org/10.1111/sms.12797

Hayes, A. F. (2017). *PROCESS.* In (Version 3.0) www.processmacro.org

Hill, D. M., & Hemmings, B. (2015). A phenomenological exploration of coping responses associated with choking in sport. *Qualitative Research in Sport, Exercise and Health*, *7*(4), 521–538. https://doi.org/10.1080/2159676X.2014.981573

IBM Corp. (2017). *IBM SPSS statistics for windows, version 25.0*.

Jowett, N., & Spray, C. M. (2013). British Olympic hopefuls: The antecedents and consequences of implicit ability beliefs in elite track and field athletes. *Psychology of Sport and Exercise*, *14*(2), 145–153. https://doi.org/10.1016/j.psychsport.2012.09.003

Karwowski, M., Royston, R. P., & Reiter-Palmon, R. (2019). Exploring creative mindsets: Variable and person-centered approaches. *Psychology of Aesthetics, Creativity, and the Arts*, *13*(1), 36–48. https://doi.org/10.1037/aca0000170

Lanza, S. T., Rhoades, B. L., Nix, R. L., & Greenberg, M. T. (2010). Modeling the interplay of multilevel risk factors for future academic and behavior problems: A person-centered approach. *Development and Psychopathology*, *22*(2), 313–335. https://doi.org/10.1017/S0954579410000088

Lee, I. A., & Preacher, K. J. (2013). Calculation for the test of the difference between two dependent correlations with one variable in common [Computer software]. http://quantpsy.org

Lüftenegger, M., & Chen, J. A. (2017). Conceptual issues and assessment of implicit theories. *Zeitschrift für Psychologie*, *225*(2), 99–106. https://doi.org/10.1027/2151-2604/a000286

Martens, R., Vealey, R. S., & Burton, D. (1990). *Competitive anxiety in sport*. Human Kinetics.

Meltzoff, J., & Cooper, H. (2018). *Critical thinking about research: Psychology and related fields* (2nd. ed). American Psychological Association.

Merz, E. L., & Roesch, S. C. (2011). A latent profile analysis of the five factor model of personality: Modeling trait interactions. *Personality and Individual Differences*, *51*(8), 915–919. https://doi.org/10.1016/j.paid.2011.07.022

Nicholls, A. R., Polman, R. C., Levy, A. R., & Borkoles, E. (2010). The mediating role of coping: A cross-sectional analysis of the relationship between coping self-efficacy and coping effectiveness among athletes. *International Journal of Stress Management*, *17*(3), 181–192. https://doi.org/10.1037/a0020064

Nicholls, A. R., & Polman, R. C. J. (2007). Coping in sport: A systematic review. *Journal of Sports Sciences*, *25*(1), 11–31. https://doi.org/10.1080/02640410600630654

Nicholls, A. R., Taylor, N. J., Carroll, S., & Perry, J. L. (2016). The development of a new sport-specific classification of coping and a meta-analysis of the relationship between different coping strategies and moderators on sporting outcomes. *Frontiers in Psychology*, *7*, 1674. https://doi.org/10.3389/fpsyg.2016.01674

Nicolas, M., Gaudreau, P., & Franche, V. (2010). Perception of coaching behaviors, coping, and goal attainment in a sport competition. *Journal of Exercise, Movement, and Sport*, *33*(3), 145–145. https://doi.org/10.1123/jsep.33.3.460

Pons, J., Viladrich, C., Ramis, Y., & Polman, R. (2018). The mediating role of coping between competitive anxiety and sport commitment in adolescent athletes. *Spanish Journal of Psychology*, *21*(E7), 1–8. https://doi.org/10.1017/sjp.2018.8

Schaefer, J., Vella, S. A., Allen, M. S., & Magee, C. A. (2016). Competition anxiety, motivation, and mental toughness in golf. *Journal of Applied Sport Psychology*, *28*(3), 309–320. https://doi.org/10.1080/10413200.2016.1162219

Shaffer, C. T., Tenenbaum, G., & Eklund, R. C. (2015). Implicit theories of mental skills abilities in collegiate athletes. *Journal of Applied Sport Psychology*, *27*(4), 464–476. https://doi.org/10.1080/10413200.2015.1044136

Sigmundsson, H., Clemente, F. M., & Loftesnes, J. M. (2020). Passion, grit and mindset in football players. *New Ideas in Psychology*, *59*, 100797. https://doi.org/10.1016/j.newideapsych.2020.100797

Slater, M. J., Spray, C. M., & Smith, B. M. (2012). "You're only as good as your weakest link": implicit theories of golf ability. *Psychology of Sport and Exercise*, *13*(3), 280–290. https://doi.org/10.1016/j.psychsport.2011.11.010

Smith, R. E., Schutz, R. W., Smoll, F. L., & Ptacek, J. T. (1995). Development and validation of a multidimensional measure of sport-specific psychological skills: The athletic coping skills inventory-28. *Journal of Sport & Exercise Psychology*, *17*(4), 379–398. https://doi.org/10.1123/jsep.17.4.379

Spray, C. M., Wang, C. J., Biddle, S. J., Chatzisarantis, N. L., & Warburton, V. E. (2006). An experimental test of self-theories of ability in youth sport. *Psychology of Sport and Exercise*, *7*(3), 255–267. https://doi.org/10.1016/j.psychsport.2005.05.001

Stenling, A., Hassmén, P., & Holmström, S. (2014). Implicit beliefs of ability, approach-avoidance goals and cognitive anxiety among team sport athletes. *European Journal of Sport Science*, *14*(7), 720–729. https://doi.org/10.1080/17461391.2014.901419

Vella, S. A., Braithewaite, R. E., Gardner, L. A., & Spray, C. M. (2016). A systematic review and meta-analysis of implicit theory research in sport, physical activity, and physical education. *International Review of Sport and Exercise Psychology*, *9*(1), 191–214. https://doi.org/10.1080/1750984X.2016.1160418

Vella, S. A., Cliff, D. P., Okely, A. D., Weintraub, D. L., & Robinson, T. N. (2014). Instructional strategies to promote incremental beliefs in youth sport. *Quest*, *66*(4), 357–370. https://doi.org/10.1080/00336297.2014.950757

Wang, C. J., & Biddle, S. J. (2001). Young people's motivational profiles in physical activity: A cluster analysis. *Journal of Sport and Exercise Psychology*, *23*(1), 1–22. https://doi.org/10.1123/jsep.23.1.1

Wang, C. J., Chatzisarantis, N. L., Spray, C. M., & Biddle, S. J. (2002). Achievement goal profiles in school physical education: Differences in self-determination, sport ability beliefs, and physical activity. *British Journal of Educational Psychology*, *72*(3), 433–445. https://doi.org/10.1348/000709902320634401