Imagery Use Gender Differences Across Competition and Training Contexts in Australian Elite Level Athletes

Geoff P Lovell[1,2], James Bierton[2], Adam D. Gorman[2,3], Michael Lloyd[4,5], Alexandra Gorman[5,6,7],
&
John K Parker[8]

[1]School of Psychology, University of Worcester, Worcester, Worcestershire, UK. Email geoffplovell@live.com
[2]School of Health, University of the Sunshine Coast, Maroochydore, Queensland, Australia. Email: james.bierton@outlook.com
[3]School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Queensland, Australia. Email: adam.gorman@qut.edu.au
[4]National Tennis Academy, Tennis Australia, Tennyson, Queensland, Australia. Email: Michael.lloyd@tennis.com.au
[5] National Cricket Centre, Cricket Australia, Albion, Queensland, Australia.
[6]Queensland Cricket, Albion, Queensland, Australia. Email: alex.m.gorman@gmail.com
[7]Queensland Academy of Sport, Department of Tourism, Innovation and Sport, QSAC, Brisbane, Queensland, Australia.
[8]Department of Sport, Hartpury University, Gloucester, Gloucestershire, UK. Email: john.parker@hartpury.ac.uk

Abstract

This study examined which functions of imagery are most frequently used by elite athletes, whether imagery usage differs between training and competing contexts, if imagery use differs between genders, and whether any gender differences in imagery use interacts with training and competition contexts. To address these aims, 62 participants, consisting of elite male and female cricketers and Australian Football League players, completed the Sports Imagery Questionnaire in both training and competition contexts. Results demonstrated that motivational general-mastery imagery (MG-M) imagery was significantly the most frequently used imagery function, with male athletes reporting using imagery significantly more frequently than the female athletes. Furthermore, a significant gender by context interaction demonstrated that the male athletes used imagery significantly more frequently prior to competing compared to prior to training, whilst conversely the female athletes used imagery significantly more frequently prior to training compared to competition. Implications for these findings are discussed.

Key Words: mental imagery; gender; training; competition; cricket; AFL; Australia.

Imagery Use Gender Differences Across Competition and Training Contexts in Australian Elite Level Athletes

Psychological techniques are often utilised by athletes and recommended by sport psychologists as a means to facilitate improvements in psychological and physical performance (Lovell & Parker, 2022). Indeed, a variety of these techniques (e.g., self-talk, goal-setting) have been identified as beneficial to athletic performance (Van Raalte & Brewer, 2014). Imagery is one such technique that has generated considerable research interest to date (e.g., Cumming et al., 2006; Gregg et al., 2007; Munroe-Chandler et al., 2012; Nordin & Cumming, 2008; Ramsey et al., 2008; White & Hardy, 1998), and found to be frequently adopted by athletes (Arvinen-Barrow et al., 2007). While various definitions of imagery exist, specific to the sport psychology literature, imagery requires the deliberate construction of an image from information stored in memory, consisting of quasi-sensorial, quasi-affective, and quasi-perceptual components (Morris et al., 2005), where the general intention is to create representative, vivid, and sensory-rich images that reinforce the desired performance outcomes and/or optimise psychological functions (Cumming & Williams, 2012).

Imagery has been found to serve distinct functions with Paivio's (1985) seminal investigation demonstrating that imagery serves both cognitive and motivational purposes at either a general or specific level (Watt et al., 2008). The General Analytic Framework that flowed from Paivio's (1985) work led to the conceptualisation of four types of imagery which have subsequently been developed further by Hall and colleagues (1998) via the design of the Sport Imagery Questionnaire (SIQ). Collectively, this work has identified five functions of imagery that are utilised by athletes. These include Cognitive specific imagery (CS: e.g., imagining the rehearsal of technique), Cognitive general imagery (CG: e.g., mentally rehearsing strategies and game plans), Motivational specific imagery (MS: e.g., simulation of goal achievement scenarios), Motivational general-arousal imagery (MG-A: e.g., imaging the regulation of arousal levels and emotional states), and Motivational general-mastery imagery (MG-M: e.g., the mental rehearsal of being in control, achieving success, and feeling confident when performing in the face of challenges).

Empirical research has demonstrated that imagery use can have a tangible benefit upon athletic performance (Cumming & Williams, 2012). For example, CS imagery has been shown to improve serving accuracy and velocity amongst elite tennis players (Guillot et al., 2012), and passing ability in elite youth soccer players (Seif-Barghi et al., 2013). CG imagery has been associated with increased confidence levels in novice netball players (Callow & Hardy, 2001), and contributed to increased team cohesion in soccer, basketball, and volleyball players (Adegbesan, 2010). Studies investigating MG-A have reported athletes found improvements in regulating pre-competitive anxiety (Mellalieu et al., 2009), and increased self-efficacy levels by reducing stress (Jones et al., 2002). Athletes adopting MG-M imagery were found to increase their subsequent self-efficacy levels resulting in improvements in golf performance (Munroe-Chandler et al., 2008). Finally, Driediger et al. (2006) reported that MS imagery use aided injured athletes to motivate themselves to complete exercises as part of their rehabilitation program.

A number of factors have been reported as influential in determining the effectiveness of imagery to enhance motor learning and sport performance (see Slimani et al., 2016). Of these, the context in which an athlete performs has proven to be of consequence to the function and frequency the imagery is used (e.g., Arvinen-Barrow et al., 2007; Munroe et al., 1998). For example, an investigation by Munroe et al. (1998) tracked imagery use at the start of a competitive season, where the focus was on training and acquiring skills, to a period immediately before the season's benchmark event (e.g., grand finals). Athletes representing 10 different sports completed the SIQ two weeks before competition games started, and again two weeks before they competed in championship games. The results indicated that athletes used more imagery later in the season compared to earlier in the season. In a related investigation, Arvinen-Barrow et al. (2007) examined how athletes used imagery during the 24-hour lead-up to competing. The results indicated that MG-M imagery was most frequently adopted, followed by CS, MG-A, and CG, with MS imagery used the least. However, these authors did not specifically address differences in imagery use between training and competition contexts. Thus, the question of whether imagery use varies when athletes are faced with a proximal interchange between training and competition contexts remains an underdeveloped area of research.

Imagery ability has been characterised as an individual's capacity to create, control, and retain vivid images (see McLean & Richardson, 1994). Indeed, the success of imagery interventions can be influenced by an individual's imagery ability, with those reporting enhanced imagery ability recording better intervention outcomes (e.g., Robin et al., 2007). Evidence also supports the notion that imagery ability predicts the frequency with which athletes adopt certain imagery functions (Gregg et al., 2005, 2011). For example, in a sample of skilled golfers, internal visual imagery ability as measured using the Vividness of Movement Imagery Questionnaire-2 (Roberts et al., 2008) accounted for 12% of the variance in CS imagery use (Parker et al., 2021). In addition, gender related differences in imagery ability have been reported (e.g., Lovell & Collins, 1997), however, findings appear to be inconsistent. Indeed, Campos et al. (2004) investigated gender differences in imagery ability and reported that males had greater imagery ability, while in contrast, Williams and Cumming (2011) found female athletes had greater imagery ability than their male counterparts. Lovell and Collins (1997) also demonstrated imagery ability gender effects, where imagery ability was positively associated with faster acquisition of a movement skill for male university students, whilst female university students recorded a negative relationship. As it appears gender differences in imagery ability exist, this may also translate to differences in imagery use. Indeed, Jones et al. (2017) investigated differences in male and female college-level athletes' imagery use and found that male athletes were significantly more likely to engage in additional levels of imagery use, with more variation in imagery use than their female athlete counterparts. However, a limitation of their study was that the statistical analysis did not allow for direct comparisons in imagery use between male and female athletes. Indeed, empirical research has often reported contrasting findings in the differences between male and female athlete's imagery use (e.g., Kizildag & Tiryaki, 2012; Salmon et al., 1994). These differences may be due to some sport types being more gender neutral, while others are perceived as predominantly male or female orientated. This may result in the presence of a self-selection sport type bias (Kizildag & Tiryaki, 2012), which could be mitigated if single sports were examined, rather than pooling the data across multiple sport types.

Despite previous empirical research that has reported the benefits of imagery use in sport and performance contexts (e.g., Callow & Hardy, 2001; Mellalieu et al., 2009; Nordin & Cumming, 2005), and evidence indicating that imagery use varies across a competitive season (Munroe et al., 1998), research in this area has two prominent omissions that need to be addressed. Specifically, the use of imagery immediately before training and competing, and secondly, whether differences in imagery use between male and female athletes emerge as a consequence of contextual changes. In response to these omissions, our study aimed to address the following research questions: 1) What functions of imagery use are most frequently used by elite athletes and are there differences between training and competing contexts? 2) Are there differences in imagery use between elite male and female athletes? And 3) Do gender differences in imagery function use interact with training and competition contexts in elite level athletes.

Method

Participants

Participants consisted of male and female elite cricketers, and male and female elite Australian Football League (AFL) players. Male and female cricket players were recruited from the elite national scholarship and professionally contracted players. The AFL players, both male and female, were recruited from a Premier Professional National League Scholarship Program. The investigation received institutional ethical approval (S/16/934), and all participants were informed of the study's purpose after which participants provided written consent knowing that they could withdraw their involvement from the study at any time.

Of the one hundred and ten participants who volunteered to take part in this study (M_{age} = 18.2 years, SD_{age} = 2.9, males = 59%), 62 participants (27 female, 35 male) completed the questionnaires in both the training and competition contexts, representing a completion rate of 56% (M_{age} = 19.0 years, SD_{age} = 3.3, males = 56%, cricket players = 50%). For those participants who completed questions in both the training and the competition contexts, there were very few cases of missing data (approximately 3%) and no participants had more than 5% missing data on any one questionnaire. The mean age of both female and male groups was 19.0 years (female SD_{age} = 4.0, male SD_{age} = 2.6).

Measures

The Sports Imagery Questionnaire (*SIQ*; Hall et al., 1998) records the frequency of cognitive and motivational functions of imagery use. The 30 item SIQ was developed to assess athletes' imagery use and is based on the mental imagery functions proposed by Paivio (1985), and subsequently extended by Hall et al. (1998). The SIQ consists of five subscales and includes Cognitive specific imagery (CS: *"I can easily change the image of a skill"*), Cognitive general imagery (CG: *"I make up new plans/strategies in my head"*), Motivational specific imagery (MS: *"I imagine myself being interviewed as a champion"*), Motivational general-arousal imagery (MG-A: *"I image the stress and anxiety associated with my sport"*), and Motivational general-mastery imagery (MG-M: "*I image myself being mentally tough"*). Participants' self-reported use of imagery was assessed via a 7-point Likert scale anchored at "rarely" (1) to "often" (7). Frequency of imagery use was calculated by summing item scores for each subscale divided by the number of items in the scale, thus resulting in possible scores from 1 to 7, with higher scores representing more frequent imagery use. The SIQ have been shown to possess satisfactory internal reliability scores with alpha coefficients of $\alpha > 0.7$ across all subscales (see Hall et al., 1998).

Procedure

Upon receiving institutional ethical approval and written informed consent, participants completed the SIQ within two hours preceding either a training setting or competitive match, with a maximum time duration of one week between these data collection points. In addition, the questionnaire included age and gender demographic data.

Data Analysis

Prior to analyses, data were checked for abnormalities and compliance with associated assumptions. Normal distribution assumption was checked by assessing the skewness and kurtosis scores, and determining the z-score. Using the guideline suggested by Ghasemi and Zahediasl (2012), a z-score of ± 3.29 was used to assess skewness and kurtosis. To determine the trustworthiness of the data, the data were checked for abnormal values by auditing approximately 10% of the data, and by checking the minimum and maximum values. No values were found to be incorrectly entered or to have exceeded the minimum or maximum values. For the completed questionnaires, approximately 3% of the data were missing. Where participants had less than 5% missing data on the questionnaire, missing data were dealt with using the mean imputation method, which is considered to be an effective method of dealing with few cases of missing data as they do not greatly influence the variation of the data (see Tabachnick & Fidell, 2013). If participants had greater than 5% missing data, they were removed from the analyses. Where participants did not complete the questionnaire in either context (training or competition), they were excluded from the analyses. To assess the research questions, a mixed design 3-way analysis of variance (ANOVA) was conducted in jamovi (version 2.3.21, The jamovi Project, 2022) with imagery use as the dependent variable. The design of the mixed ANOVA was imagery function (CS, CG, MS, MG-A, and MG-M), by context (training and competition), by gender (male and female), with repeated measures on the first two factors. Significance was set at the 95% level of confidence. Where Mauchly's test demonstrated that the assumption of sphericity was violated, Greenhouse-Geisser corrections were applied. Significant ANOVA main effects and interactions were integrated by Tukey post hoc tests. Significance was set at $\alpha = .05$. Partial-eta squared was used to determine effect sizes; small ($\eta_p^2 > .01$), medium ($\eta_p^2 > .06$), or large ($\eta_p^2 > .14$) (Cohen, 1988).

Results

Descriptive statistics, inter-correlations between assessed variables, and internal reliability Cronbach alpha coefficients are presented in Table 1. Alpha scores for each of the SIQ subscales in both training and competition contexts exceeded .7, indicating satisfactory internal reliability (Field, 2017). Normality was assessed by Shapiro-Wilk tests; only three of the ten dependent variables were shown not to be normal (competition-MG-A, training- MG-A, and training-MG-M). Given that the analyses used in this study are shown to be robust against non-normal distributions (see Wadgave, 2019), the original scores were used.

Table 1

Descriptive Statistics, Internal Consistency, and Inter-Correlations for Imagery Use in the Training and Competition Contexts

Measure	α	*M*	*SD*	1	2	3	4	5	6	7	8	9
1.T-CS	.83	4.66	1.02	-	-	-	-	-	-	-	-	-
2.T-CG	.76	4.42	0.94	.72*	-	-	-	-	-	-	-	-
3.T-MS	.79	4.28	1.14	.57*	.59*	-	-	-	-	-	-	-
4.T-MG-A	.69	4.32	0.99	.54*	.61*	.58*	-	-	-	-	-	-
5.T-MG-M	.80	4.81	1.04	.72*	.75*	.68*	.60*-	-	-	-	-	-
6.C-CS	.84	4.60	1.05	.73*	.57*	.37*	.40*	.55*	-	-	-	-
7.C-CG	.76	4.36	0.93	.66*	.74*	.46*	.56*	.62*	.73*	-	-	-
8.C-MS	.81	4.26	1.17	.62*	.59*	.81*	.57*	.63*	.57*	.57*	-	-
9.C-MG-A	.77	4.31	1.04	.57*	.61*	.49*	.81*	.61*	.65*	.65*	.64*	-
10.C-MG-M	.85	4.85	1.12	.68*	.66*	.53*	.57*	.75*	.74*	.78*	.66*	.72*

Note. n = 62; *p < .05, T-CS = cognitive specific imagery in training context, T-CG = cognitive general imagery in training context, T-MS = motivational specific imagery in training context, T-MG-A = motivational general-arousal imagery in training context, T-MG-M = motivational general-mastery imagery in training context, C-CS = cognitive specific imagery in competition context, C-CG =

cognitive general imagery in competition context, C-MS = motivational specific imagery in competition context, C-MG-A = motivational general-arousal imagery in competition context, C-MG-M = motivational general-mastery imagery in competition context.

In terms of the most frequently used imagery functions by elite athletes and whether this differed between training and competing contexts, the results of the mixed design 3-way ANOVA (imagery function by context by gender) indicated a significant main effect for imagery function with medium effect size, F (3.40, 203.88) = 8.965, p <.001, n_p^2 = .130. Post-hoc analysis of the main effect for imagery function based on marginal means (combined competition and training contexts) demonstrated that the athletes implemented significantly more frequent MG-M imagery compared to the other functions of imagery use. The second most frequently used imagery function was CS, with MS imagery used the least (see Figure 1).

Insert Figure 1 about here

No significant context main effect was observed, F (1, 60) = 1.695, p = .198, n_p^2 = .027, nor was there a significant imagery function by context interaction, F (3.60, 215.85) = 0.602, p = .644, n_p^2 = .010.

Regarding whether there were differences in imagery use between male and female athletes, the ANOVA demonstrated a significant main effect for gender with a large effect size, F (1, 60) = 17.4, p < .001, n_p^2 = .225. This main effect for gender revealed that male athletes (M_{males} = 4.87, SD_{males} = 0.60) used imagery significantly, and meaningfully, more frequently than the female athletes ($M_{females}$ = 4.02, $SD_{females}$ = 0.98).

Considering whether gender differences in imagery use interacted with imagery function or training and competition contexts, interpretation of the ANOVA results indicated a significant gender by context interaction with medium effect size, *F* (1, 60) = 5.754, *p* = 0.020, n_p^2 = .088. Post hoc examination of the significant interaction demonstrated that the male athletes used imagery significantly more frequently prior to competing (*M* = 4.90, *SD* = 0.58) compared to their use of imagery prior to training (*M* = 4.83, *SD* = 0.70). Conversely, the female athletes used imagery significantly more frequently prior to training (*M* = 4.14, *SD* = 1.09) compared to their use of imagery prior to competing (*M* = 3.90, *SD* = 1.00). Echoing the gender main effect, post hoc tests also showed that the males used imagery significantly more frequently than the female athletes in both the competition and training contexts (see Figure 2).

Insert Figure 2 about here

No significant imagery function by gender interaction was observed, *F* (3.40, 203.88) = 2.036, *p* = .102, n_p^2 = .033, nor was there a significant imagery function by context by gender interaction, *F* (3.60, 215.85) = 0.718, *p* = .566, n_p^2 = .012 (see Table 2).

Table 2

Male and female athletes' imagery use in training and competition contexts

Gender	Context	Imagery Function				
		CS	CG	MS	MG-A	MG-M
Males						
	Training	5.18	4.78	4.51	4.52	5.17
		(0.80)	(0.96)	(1.14)	(0.89)	(0.84)
	Competition	5.12	4.82	4.67	4.62	5.29
		(0.69)	(0.64)	(1.01)	(0.90)	(0.74)
Females						
	Training	4.14	4.12	4.04	4.06	4.36
		(1.25)	(1.13)	(1.32)	(1.17)	(1.25)
	Competition	3.93	3.75	3.72	3.91	4.17
		(1.07)	(0.91)	(1.18)	(1.09)	(1.23)

Note. Means in normal text with standard deviations in parenthesis, CS = cognitive specific imagery, CG = cognitive general imagery, MS = motivational specific imagery, MG-A = motivational general-arousal imagery, MG-M = motivational general-mastery imagery.

Discussion

The aims of the current study were to investigate which functions of imagery use were most frequently adopted by elite athletes, and whether there were differences between training and competition contexts. In addition, we examined whether elite level male and female athletes differed in the frequency of imagery use, and whether gender differences in imagery function interacted with training and competition contexts. To the best of our knowledge, our study is the first to investigate imagery use in elite Australian athletes who compete in cricket and AFL, and the first to identify imagery use differences between male and female elite athletes relative to these contexts. In addition, this is one of the first studies to investigate elite athlete's imagery use immediately prior to training and competing.

The frequency of imagery use amongst our sample of athletes was found to be consistent with previous research by Arvinen-Barrow et al. (2007), who reported similar results. The main difference being that MS imagery was used the least in our sample, whereas MG-A was used more than CG and MS imagery in the Arvinen-Barrow et al. (2007) sample. This trend of imagery use potentially reflects how each type is believed to influence performance. For example, MG-M imagery has been shown to have the greatest indirect influence upon performance, allowing athletes to develop mental toughness and confidence prior to competing (see Beauchamp et al., 2002; Callow & Hardy, 2001), hence why athletes may use this imagery function significantly more than the other functions. In addition, athletes in our sample reported using CS imagery to a lesser extent than MG-M, but they used CS imagery more frequently than the remaining functions of imagery use.

There was no significant difference in imagery use between training and competition contexts, although there were differences in imagery use between male and female athletes. This result is in accordance with Jones et al. (2017) who reported that athletes' sex and sport skill type (i.e., open v closed-skill) were associted with the frequency of imgery use, with male athletes recording higher values in CS, MS, and MG-M functions of imagery use. More specifically in our sample, male athletes used all imagery functions to a greater extent prior to competing, whereas there were no significant differences in imagery use between these two contexts for female athletes. The increase in imagery use from training to competition for male athletes is consistent with research conducted by Munroe et al. (1998), who reported imagery use increased early in the season when training was the focus, to later in the season, where competing became more focal. As this was not the case for female athletes, there are possible speculative explanations that can be proffered. The first is related to the current status of many female sports. Cricket and AFL competitions for female athletes are still developing and are not at the same level as male sports, as evidenced by funding levels for female competitions (Cricket Australia, 2018; Tyeson, 2018). Consequently, female athletes may not have had the same exposure to psychological skills training as their male counterparts, thereby resulting in comparatively less impetus to adopt imagery. Indeed, it is possible that a reduction in exposure could contribute to reducing the requisite knowledge needed to utilise imagery optimally. A compound effect would be that when female athletes attempt to use imagery, under guidance or not, they may be more prone to perceive imagery as an ineffective cognitive technique for the purposes of enhancing performance. To mitigate against this potential negative feedback loop, practitioners should increase female athletes' exposure to psychological skills training, especially in light of research demonstrating that prior experience of sport psychology is associated with increases in positive attitudes towards the service (Rooney et al., 2021).

There was a significant main effect for imagery use between genders, but of greater interest was the significant gender by imagery interaction effect. Overall, female athletes used imagery less than male athletes. The male athletes used MG-M and CS imagery significantly more than CG, MS, and MG-A functions of imagery use. In contrast, the female participants used MG-M imagery significantly more than other imagery functions, and did not use CS imagery significantly more than the other imagery functions, which is inconsistent with previous research (e.g., Arvinen-Barrow et al., 2007). There are two possible explanations for female athletes' lower imagery use. The first, as highlighted previously, could be that female athletes did not have the same exposure to imagery training as the male athletes in this sample, thereby reducing the likelihood of female athletes using imagery. The second possible explanation is that the use of imagery, particularly CS imagery, does not benefit female athletes' performance. Previous research has shown that female university students who have high imagery ability have lower rates of skill acquisition than females with lower imagery ability, and perform worse on the respective skill (Lovell & Collins, 1997).

To further account for the low rates of imagery use by the female athletes in the present study, it is possible that CS imagery does not benefit female athletes' understanding of motor skills in the same way as it does for male athletes. Moreover, the nature and quality of the information female athletes receive regarding skill acquisition could be compromised by virtue of promoting the procedures of male role models which is a socially driven phenomenon (i.e., more males play sport, more males coach sport). To extrapolate further, as imagery has been shown to be reliant on various cognitive sub-systems (see Kosslyn & Koening, 1992), when female athletes image a skill, it could be speculated that remnants of sub-optimal learning models are contained within the information the cognitive sub-systems used to generate the images (Lovell & Collins, 1997). The end result could be that imagery would be more likely to be used by male athletes, thus leading female athletes to view CS imagery as a less favourable strategy compared to their male counterparts.

In addition, it would also account for the possibility that female athletes do not benefit from imagery use to the same extent as males, due to differences in preferred learning style (see Kulturel-Konak et al., 2011). For example, female participants have been shown to prefer using a learning style that is based more on intuition and feeling (Heffler, 2001). Therefore, implementing imagery as a psychological technique to promote understanding of sports skills and strategies may either have less benefit for female athletes or may be perceived to offer less utility. Hence, future empirical research should seek to establish whether exposure rates to psychological skills training and preferred learning styles account for these observed gender differences in imagery use between training and competition contexts.

A specific limitation of this research was the difficulty in accessing a larger sample of elite level competitors immediately prior to competition due to the potentially disruptive effects upon their preparation and subsequent performance. This is a challenge that is reflected in the sample size of our current research. A further limitation is the variability in extents, duration, and nature of sport psychology support and instruction that exist in elite sport, and how this may also differ between nations, and especially its availability for female athletes. Due to this variation, it is difficult to assess how these findings generalise to other contexts. Additionally, while the present research utilised a methodology that assessed imagery use prior to competition and training, future research should attempt to assess imagery use during competition and training. However, such data would likely be challenging to acquire without the development of novel approaches that enable the collection of real time data without disrupting performance and usual patterns of imagery use. Additionally, with specific reference to female athletes, future research should determine how imagery benefits performance, in both relative and absolute terms.

In conclusion, our study found that female athletes used all imagery types less than male athletes, which was consistent in both training and competition contexts. It was also found that male athletes used more imagery prior to competing than prior to training. Two explanations of these findings were offered. The first explanation was that female athletes may not have the same opportunities as male athletes to develop their imagery skills. The second explanation was that female athletes may not benefit from imagery to the same extent as males, and may therefore tend to use imagery to a lesser extent when compared to their male counterparts. It is therefore recommended that future research should further explore the potential benefits of imagery in female athletic populations by using imagery interventions that are sufficiently bespoke for the needs of female athletes.

References

Adegbesan, O. A. (2010). Botswana team sport players' perception of cohesion and imagery use in sport. *South African Journal for Research in Sport, Physical Education and Recreation, 32*(1), 1-9.

Arvinen-Barrow, M., Weigand, D. A., Thomas, S., Hemmings, B., & Walley, M. (2007). Elite and novice athletes' imagery use in open and closed sports. *Journal of Applied Sport Psychology, 19*(1), 93-104. https://doi.org/10.1080/10413200601102912

Beauchamp, M. R., Bray, S. R., & Albinson, J. G. (2002). Pre-competition imagery, self-efficacy and performance in collegiate golfers. *Journal of Sports Sciences, 20*(9), 697-705. doi: 10.1080/026404102320219400

Callow, N., & Hardy, L. (2001). Types of imagery associated with sport confidence in netball players of varying skill levels. *Journal of Applied Sport Psychology, 13*(1), 1-17. https://doi.org/10.1080/10413200109339001

Callow, N., Hardy, L., & Hall, C. (2001). The effects of a motivational general-mastery imagery intervention on the sport confidence of high-level badminton players. *Research Quarterly for Exercise and Sport, 72*(4), 389-400. https://doi.org/10.1080/02701367.2001.10608975

Campos, A., Pérez-Fabello, M. A. J., & Gómez-Juncal, R. O. (2004). Gender and age differences in measured and self-perceived imaging capacity. *Personality and Individual Differences, 37*(7), 1383-1389. https://doi.org/10.1016/j.paid.2004.01.008

Cohen J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). L. Erlbaum Associates.

Cricket Australia (2018). *Growing cricket for girls: 2018/19 funding guidelines.* Retrieved from https://community.cricket.com.au/clubs/a-sport-for-all/growing-cricket-for-girls

Cumming, J., Nordin, S. M., Horton, R., & Reynolds, S. (2006). Examining the direction of imagery and self-talk on dart-throwing performance and self efficacy. *The Sport Psychologist, 20*, 257-274. https://doi.org/10.1123/tsp.20.3.257

Cumming, J., & Williams, S. E. (2012). The role of imagery in performance. In S. M. Murphy (Ed.), *The Oxford handbook of sport and performance psychology* (pp. 213–232). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199731763.013.0011

Driediger, M., Hall, C., & Callow, N. (2006). Imagery use by injured athletes: A qualitative analysis. *Journal of Sports Sciences*, *24*(3), 261-272. https://doi.org/10.1080/02640410500128221

Field, A. (2017). *Discovering statistics using IBM SPSS statistics* (5th ed.). *Sage*.

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: a guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*(2), 486-489. doi: 10.5812/ijem.3505

Gregg, M., Hall, C., & Nederhof, E. (2005). The imagery ability, imagery use, and performance relationship. *The Sport Psychologist, 19,* 93-99.

Gregg, M., Hall, C., & Hanton, S. (2007). Perceived effectiveness of heptathletes' mental imagery. *Journal of Sport Behavior, 30*(4), 398-414.

Gregg, M., Hall, C., McGowan, E., & Hall, N. (2011). The relationship between imagery ability and imagery use among athletes. *Journal of Applied Sport Psychology, 23*(2), 129-141. https://doi.org/10.1080/10413200.2010.544279

Guillot, A., Genevois, C., Desliens, S., Saieb, S., & Rogowski, I. (2012). Motor imagery and 'placebo-racket effects' in tennis serve performance. *Psychology of Sport and Exercise, 13*(5), 533-540. https://doi.org/10.1016/j.psychsport.2012.03.002

Hall, C. R., Mack, D. E., Paivio, A., & Hausenblas, H. A. (1998). Imagery use by athletes: Development of the Sport Imagery Questionnaire. *International Journal of Sport Psychology, 29*(1), 73-89.

Heffler, B. (2001). Individual learning style and the learning style inventory. *Educational Studies, 27*(3), 307-316.

The jamovi Project (2022). jamovi (Version 2.3) [Computer Software]. Retrieved from https://www.jamovi.org

Jones, D., Polasek, K. M., Foley, J. T., & Lind, E. (2017). The relationship of sex and sport skill type on imagery use among division III athletes. *Journal of Sport Behavior*, *40*(3), 297.

Jones, M. V., Mace, R. D., Bray, S. R., MacRae, A. W., & Stockbridge, C. (2002). The impact of motivational imagery on the emotional state and self-efficacy levels of novice climbers. *Journal of Sport Behavior, 25*(1), 57.

Kizildag, E., & Tiryaki, M. Ş. (2012). Imagery use of athletes in individual and team sports that require open and closed skill. *Perceptual and Motor Skills, 114*(3), 748-756. doi: 10.2466/05.20.22.PMS.114.3.748-756

Kosslyn, S. M. & Koenig, O. (1992). *The wet mind: The new cognitive neuroscience*. The Free Press: New York.

Kulturel-Konak, S., D'Allegro, M. L., & Dickinson, S. (2011). Review of gender differences in learning styles: Suggestions for STEM education. *Contemporary Issues in Education Research, 4*(3), 9.

Lovell, G. P., & Collins, D. (1997). The mediating role of sex upon the relationship between mental imagery ability and movement skill acquisition rate. *Journal of Human Movement Studies, 32*(5), 187-210.

Lovell , G. P., & Parker, J. L. (2022). Imagery and mental practice. In D. J. Collins & A. Cruickshank (Eds.), *Sport psychology essentials* (pp 105-118). Human Kinetics.

McLean, N., & Richardson, A. (1994). The role of imagery in perfecting already learned physical skills. *Imagery in sports and physical performance*, 59-74.

Mellalieu, S. D., Hanton, S., & Thomas, O. (2009). The effects of a motivational general-arousal imagery intervention upon preperformance symptoms in male rugby union players. *Psychology of Sport and Exercise, 10*(1), 175-185. doi: 10.1016/j.psychsport.2008.07.003

Morris, T., Spittle, M., & Watt, A. P. (2005). *Imagery in sport*. Lower Mitcham, SA: Human Kinetics.

Munroe-Chandler, K., Hall, C., & Fishburne, G. (2008). Playing with confidence: The relationship between imagery use and self-confidence and self-efficacy in youth soccer players. *Journal of Sports Sciences, 26*(14), 1539-1546. doi: 10.1080/02640410802315419

Munroe-Chandler, K. J., Hall, C. R., Fishburne, G. J., Murphy, L., & Hall, N. D. (2012). Effects of a cognitive specific imagery intervention on the soccer skill performance of young athletes: Age group comparisons. *Psychology of Sport and Exercise, 13*(3), 324-331. doi: 10.1016/j.psychsport.2011.12.006

Munroe, K., Hall, C., Simms, S., & Weinberg, R. (1998). The influence of type of sport and time of season on athletes' use of imagery. *Sport Psychologist, 12*, 440-449. doi: 10.1123/tsp.12.4.440

Nordin, S. M., & Cumming, J. (2005). Professional dancers describe their imagery: Where, when, what, why, and how. *The Sport Psychologist, 19*(4), 395-416. doi: 10.1123/tsp.19.4.395

Nordin, S. M., & Cumming, J. (2008). Types and functions of athletes' imagery: Testing predictions from the applied model of imagery use by examining effectiveness. *International Journal of Sport and Exercise Psychology, 6*(2), 189-206. doi: 10.1080/1612197X.2008.9671861

Paivio, A. (1985). Cognitive and motivational functions of imagery in human performance. *Canadian Journal of Applied Sport Sciences. Journal Canadien Des Sciences Appliquées Au Sport, 10*(4), 22-28.

Parker, J., Lovell, G., & Jones, M. (2021). An examination of imagery ability and imagery use in skilled golfers. *Journal of Imagery Research in Sport and Physical Activity*, *16*(1), 20210006. https://doi.org/10.1515/jirspa-2021-0006

Ramsey, R., Cumming, J., & Edwards, M. G. (2008). Exploring a modified conceptualization of imagery direction and golf putting performance. *International Journal of Sport and Exercise Psychology, 6*(2), 207-223. doi: 10.1080/1612197X.2008.9671862

Roberts, R., Callow, N., Hardy, L., Markland, D., & Bringer, J. (2008). Movement Imagery Ability: Development and Assessment of a Revised Version of the Vividness of Movement Imagery Questionnaire. *Journal of Sport and Exercise Psychology*, *30*(2), 200-221. https://doi.org/10.1123/jsep.30.2.200

Robin, N., Dominique, L., Toussaint, L., Blandin, Y., Guillot, A., & Le Her, M. (2007). Effects of motor imagery training on service return accuracy in tennis: The role of imagery ability. *International Journal of Sport and Exercise Psychology*, *5*(2), 175-186. https://doi.org/10.1080/1612197X.2007.9671818

Rooney, D., Jackson, R.C., & Heron, N. (2021). Differences in the attitudes to sport psychology consulting between individual and team sport athletes. *BMC Sports Science, Medicine and Rehabilitation 13*, 46. https://doi.org/10.1186/s13102-021-00271-7

Salmon, J., Hall, C., & Haslam, I. (1994). The use of imagery by soccer players. *Journal of Applied Sport Psychology, 6*(1), 116-133. doi: 10.1080/10413209408406469

Seif-Barghi, T., Kordi, R., & Memari, A. H. (2013). Effect of mental imagery on performance elite athletes' in youth and adult age groups: A randomized trial. *Tehran University Medical Journal, 71*(3), 171-178.

Slimani, M., Chamari, K., Boudhiba, D., & Chéour, F. (2016). Mediator and moderator variables of imagery use-motor learning and sport performance relationships: A narrative review. *Sport Sciences for Health, 12*(1). https://doi.org/10.1007/s11332-016-0265-1

Tabachnick, B.G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). New Jersey: Pearson, Pearson.

Tyeson, C. (2018). Ex-AFL exec claims a 1% pay cut for men would fund a 100% rise for women. *Pedestrian.* Retrieved from https://www.pedestrian.tv/sport/afl-exec-claims-pay-cut-for-men-would-fund-pay-rise-for-women/

Van Raalte, J. L., & Brewer, B. W. (2014). *Exploring sport and exercise psychology* (3rd ed.). Washington DC: American Psychological Association. doi: 10.1037/14251-000

Wadgave, U. (2019). Parametric test for non-normally distributed continuous data: For and against: Array. *Electronic Physician*, *11*(2), 7468-7470.

Watt, A. P., Spittle, M., Jaakkola, T., & Morris, T. (2008). Adopting Paivio's general analytic framework to examine imagery use in sport. *Journal of Imagery Research in Sport and Physical Activity, 3*(1), 10-26. doi:10.2202/1932-0191.1026

White, A., & Hardy, L. (1998). An in-depth analysis of the uses of imagery by high-level slalom canoeists and artistic gymnasts. *The Sport Psychologist, 12*(4), 387-403. doi: 10.1123/tsp.12.4.387

Williams, S. E., & Cumming, J. (2011). Measuring athlete imagery ability: the sport imagery ability questionnaire. *Journal of Sport & Exercise Psychology, 33*(3), 416-440. doi: 10.1123/jsep.33.3.416