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ORIGINAL ARTICLE

Effects of confidence and anxiety on flow state in competition

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Abstract
Confidence and anxiety are important variables that underlie the experience of flow in sport. Specifically, research has indicated that confidence displays a positive relationship and anxiety a negative relationship with flow. The aim of this study was to assess potential direct and indirect effects of confidence and anxiety dimensions on flow state in tennis competition. A sample of 59 junior tennis players completed measures of Competitive State Anxiety Inventory-2d and Flow State Scale-2. Following predictive analysis, results showed significant positive correlations between confidence (intensity and direction) and anxiety symptoms (only directional perceptions) with flow state. Standard multiple regression analysis indicated confidence as the only significant predictor of flow. The results confirmed a protective function of confidence against debilitating anxiety interpretations, but there were no significant interaction effects between confidence and anxiety on flow state.

Keywords: *Positive experience, multidimensional anxiety, flow state, competition, tennis*

Flow states are rare but extremely positive experiences in everyday life and sport (Csikszentmihalyi, 1975). Athletes in flow describe their experience as being totally absorbed in and focussed on the task at hand, feeling confident and in control (Jackson, 1995; Jackson & Csikszentmihalyi, 1999). Although flow is an ephemeral state that is difficult to control and can be easily disrupted (Jackson, 1995; Young, 2000), the experience of flow is crucial for competitive athletes in facilitating successful performances. For example, intervention studies aimed at enhancing flow state have shown a general increase in both flow and performance (e.g., Lindsay, Maynard, & Thomas, 2005; Pates, Cummings, & Maynard, 2002). Moreover, in social validation interviews, athletes reported an increase in confidence during performance (Pates, Maynard, & Westbury, 2001; Pates, Oliver, & Maynard, 2001), which appeared to be a side effect of the flow intervention. Csikszentmihalyi (1975) suggested that a perceived balance between situational challenges and personal skills is a necessary precondition to experience flow, whereas an imbalance can either lead to anxiety, apathy or boredom. In the sport-specific flow model, Kimiecik and Stein (1992) proposed that confidence and anxiety are one of the main personality variables underlying flow. Individuals with high levels of anxiety perceive that they lack the capabilities to meet the situational demands to be successful, which leads to suboptimal experiences (Csikszentmihalyi, 1975).

Research showed that several correlates underlie flow in sport, including intrinsic motivation and perceived ability (Jackson, Kimiecik, Ford, & Marsh, 1998), and psychological skills and self-concept (Jackson, Thomas, Marsh, & Smethurst, 2001). Researchers found support for a positive link between confidence and flow (Jackson, 1995; Jackson et al., 1998; Stavrou & Zervas, 2004) and a negative link between anxiety and flow (Jackson et al., 1998; Stavrou & Zervas, 2004). Using the Competitive State Anxiety Inventory-2 (CSAI-2), Stavrou and Zervas (2004) reported moderate-to-strong positive links between state confidence, and all flow dimensions, except time transformation, and low-to-moderate negative relationships between cognitive anxiety and somatic anxiety and most flow characteristics.

Multidimensional state anxiety theory proposed the conceptual independence between confidence and cognitive anxiety (Martens, Vealey, & Burton, 1990). Martens et al. (1990) advocated a positive

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relationship between performance and confidence, a negative relationship between cognitive anxiety and performance and a quadratic relationship between somatic anxiety and performance. A meta-analysis examining the predictions of multidimensional anxiety theory indicated inconsistencies in the proposed relationships (Craft, Magyar, Becker, & Feltz, 2003). Craft and colleagues (2003) found substantial evidence for the predicted confidence–performance relationship, and some, but weaker, support for the somatic anxiety–performance link. In contrast to the theoretical framework, cognitive anxiety generally displayed a positive rather than a negative relationship with performance. These findings cast doubt over the statement that cognitive and somatic anxiety components are "...always negative in direction due to their links with negative affect" (Martens, Vealey, et al., 1990, p. 6). Jones (1995) provided an argument against the one-directional interpretation of anxiety, citing evidence that anxiety can be perceived as either helpful or unhelpful.

With the introduction of a directional scale (Jones & Swain, 1992), the CSAI-2d measured anxiety intensity and directional perceptions, providing more insight into the complex relationship between confidence and anxiety. Jones, Swain, and Hardy (1993) found a positive correlation of 0.80 between confidence intensity and confidence direction. This result, supported by the previous studies (Fletcher & Hanton, 2001), led to the conclusion that the intensity and directional perception scales for confidence essentially measure the same state (Jones & Hanton, 2001). Jones and Swain (1992) proposed that athletes perceive cognitive and somatic anxiety symptoms along a continuum from debilitative to facilitative. Furthermore, Jones and Hanton (2001) provided evidence that the confidence level is particularly important for the perception of state anxiety, as confident athletes interpreted signs of state anxiety as facilitative, whereas low-confident athletes experienced anxiety as debilitative. Based on a series of semi-structured interviews with elite athletes who reported either high or low confidence, Hanton, Mellalieu, and Hall (2004) concluded that athletes with high confidence levels interpreted anxiety symptoms in a more positive way than athletes low in confidence. Even under the perception of an increase of anxiety symptoms, high confidence appeared to provide a protective function, so that anxiety symptoms were interpreted as facilitative. On the other hand, athletes with low confidence revealed the opposite pattern. Under low-confidence conditions and increasing anxiety, these performers interpreted the direction of anxiety symptoms as debilitative (Hanton et al., 2004). The results confirmed Hardy, Jones, and Gould's (1996) proposal that confidence has a protective function against debilitating anxiety effects.

Through the administration of the CSAI-2d, and a checklist of feeling state labels, Jones and Hanton (2001) found that athletes who interpreted cognitive anxiety as facilitative scored significantly higher on positive feeling states than athletes who interpreted anxiety symptoms negatively. Athletes perceiving anxiety as debilitative scored higher on negative feeling states. These research findings shifted self-confidence from the role of a by-product in multidimensional anxiety theory to the role of a moderator, where self-confidence has a major influence on the interpretation of anxiety direction. The proposal by Jones and Hanton (2001) that self-confidence might be a crucial moderator in the determination of the perception of state anxiety direction is certainly worthy of further study as it has potential implications on emotional processes and feeling states, such as flow.

To date, flow research has revealed negative links between anxiety and flow (Jackson et al., 1998; Stavrou & Zervas, 2004) and a positive relationship between confidence and flow (Jackson, 1995; Russell, 2001; Stavrou & Zervas, 2004). The investigation of the relationship between confidence and anxiety is crucial for the understanding of flow, as both constructs are at the heart of flow theory. Although the interaction between confidence and anxiety has been proposed from a multidimensional anxiety perspective (e.g., Jones & Hanton, 2001; Hanton et al., 2004), given the importance of confidence and anxiety for the experience of flow (Jackson et al., 1998), further research is necessary to examine potential moderating effects between confidence and anxiety on flow. Previous flow studies on confidence and anxiety employed samples with senior or college athletes (e.g., Jackson, 1995; Russell, 2001; Young, 2000), but little is known about the flow experience in younger samples and whether predictions of flow and multidimensional anxiety theory affect teenage athletes in a similar way. Therefore, the aim of this study was to assess potential direct and indirect effects of confidence and anxiety dimensions on flow state in junior tennis competitors. The results of this study could assist in developing interventions for young athletes that helps building confidence and dealing with anxiety symptoms in a constructive way. Based on the previous research findings, it was hypothesised that (a) flow state has a positive relationship with state confidence (e.g., Jackson, 1995; Jackson et al., 1998), (b) flow state has a negative relationship with cognitive and somatic anxiety intensity (e.g., Stavrou & Zervas, 2004), (c) intensity and direction of confidence predict flow state (e.g., Jones et al., 1993), (d) directional interpretations of anxiety symptoms are stronger predictors of flow state than anxiety intensity (e.g., Jones, 1995) and (e) confidence is a moderator between anxiety symptoms and flow state (e.g., Hanton et al., 2004; Jones & Hanton, 2001).

Methods

Participants

The sample consisted of 59 junior tennis players (35 male, 24 female) between 11 and 16 years of age ($M = 14.03$; $SD = 1.40$). Participants had been involved in tennis competitions between 1 and 7 years ($M = 3.95$; $SD = 1.42$), and the training intensity varied between 1 and 15 hours per week ($M = 5.36$; $SD = 3.60$). Although a few participants reported low competition and training experience, the majority of players (86.4%) had been playing tennis for at least four years on club level. A group of 10 participants were of an advanced skill level as reflected by their national ranking list position.

Measures

Competitive State Anxiety Inventory-2d. The original CSAI-2 consists of 27 items with 9 items per subscale, which were termed CSAI-2cog (cognitive anxiety subscale), CSAI-2som (somatic anxiety subscale) and CSAI-2sc (self-confidence subscale), and was used to assess anxiety intensity. Reliability was measured by Cronbach's alpha in three different samples, ranging from 0.79 to 0.90 for each subscale (Martens, Burton, Vealey, Bump, & Smith, 1990). The alpha values for CSAI-2 self-confidence were generally higher than the internal coefficients of the state anxiety subscales. The response format of the CSAI-2 is a four-point Likert scale asking participants to rate the intensity of their experience between 1 (*not at all*) and 4 (*very much so*). Jones and Swain (1992) modified the CSAI-2 to create the CSAI-2d by adding a directional perceptions scale to each of the original items to measure whether athletes experienced the subcomponents as facilitative or debilitative for performance. The seven-point directional scale ranges from +3 (*very facilitative*) to −3 (*very debilitative*), with 0 as neutral. Previous studies showed acceptable Cronbach alpha coefficients above 0.70 for the direction scales (Jones & Hanton, 2001).

Flow State Scale-2. The Flow State Scale-2 (FSS-2) assesses the intensity of flow state on one occasion (e.g., one tennis match). The 36-item scale consists of nine subscales, represented by challenge–skills balance, action–awareness merging, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, loss of self-consciousness, time transformation and autotelic experience. The response format is a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) with 3 as *neither agree nor disagree*. The internal consistency alpha coefficients for the nine subscales were between 0.81 and 0.90 (Jackson & Eklund, 2002).

Procedures

Following approval from the University's Ethics Committee, access was requested from tournament directors of junior tennis tournaments in Australia. Information statements and consent forms were handed out to players and parents or legal guardians before the onset of the competition. Players who wanted to join the study as volunteers and who had received consent from their parent or guardian returned the form to the researcher. After completion of the tennis match, participants were asked to provide demographic information and to complete measures of the CSAI-2d and FSS-2 in a separate room next to the tournament box. All participants received oral and written information about the measures. First, the researcher explained to the participants what the questionnaires were about and how to complete them. Second, the researcher asked the participants to read the introductory section, before moving on to the test items. Written information on how to complete the measure included an introductory part on top of each questionnaire. The researcher emphasised that all answers should be given based on the players' experiences during the last competition match. Finally, the researcher encouraged participants to ask questions both immediately after hearing and reading instructions, and at any time during the session. All participants filled out the questionnaires within half-an-hour after the end of the competition.

Design and statistical analysis

The study employed a correlational, cross-sectional design, using flow state as dependent and confidence and anxiety symptoms as independent variables. Following the competition match, participants retrospectively provided data on their experience. The FSS-2 has been developed as a measure that allows athletes to reflect on their flow state during one event (Jackson & Eklund, 2002). Data were entered into SPSS Version 15.0. Following descriptive statistics and the evaluations of the internal consistency of the scales, the conceptual independence between the CSAI-2d constructs was examined. Pearson's product moment correlation coefficients were used to examine the relationship between FSS-2 and CSAI-2d variables (hypotheses a and b), linear multiple regression analysis was used to assess confidence and anxiety symptoms (intensity and directional perceptions scales) as predictors of flow state (hypotheses c and d) and hierarchical multiple regression to test confidence as moderator between anxiety and flow (hypothesis e). To adjust for multiple comparisons, a corrected Bonferroni cut-off was used to test the hypothesis on a more stringent significance level.

Reliability and validity

Acceptable reliability values higher than 0.70 (Nunnally & Bernstein, 1994) were found for measures of CSAI-2d (intensity scale total = 0.76; direction scale total = 0.94) and FSS-2 (0.95). The alpha coefficients for the flow subscales ranged from 0.76 (action–awareness merging) to 0.88 (autotelic experience). The reliability values for the CSAI-2 intensity and direction subscales are presented in Table I. The CSAI-2som intensity subscale indicated a lower-than-desirable internal consistency of 0.67. Although item deletion would enhance alpha, Kopalle and Lehmann (1997) argued against this approach, as the recomputed alpha values may represent biased over-estimates. It is possible that the use of a more homogeneous group, in contrast to Martens et al.'s (1990) heterogeneous sample, affected the reliability scores in this study. Schmitt (1996) noted that coefficient alpha does not assess unidimensionality, and, therefore, may underestimate reliability for multidimensional scales. Given the sample specification and the reliability score being marginally below the 0.70 value, the CSAI-2som intensity scale was retained for further analysis.

This study examined the experiences of a rather young age group, and it appears valuable to assess the validity of the administered questionnaires. Previously, Stavrou and Zervas (2004) did not report any reliability or validity issues when using CSAI-2 and flow state measures within a sample of 385 athletes aged between 16 and 38 years. The results showed negative links between most of the flow subscales and CSAI-2cog and CSAI-2som, whereas time transformation did not reveal any significant relationships with the anxiety measures. Moderate-to-strong positive correlations were found for CSAI-2sc and all flow subscales, except time transformation (Stavrou & Zervas, 2004). The correlations found in this study mirrored the ones by Stavrou and Zervas (2004) in various ways. The confidence scale showed significant positive associations with eight flow subscales, with the exception of time transformation. Flow dimensions generally showed negative links with anxiety constructs, more so with cognitive than with somatic anxiety. These correlational findings on flow state and competitive anxiety indicated several similarities across samples (e.g., Stavrou & Zervas, 2004), providing support for the validity of using both measures with younger athletes.

Table I. Means, standard deviations and alpha coefficients for CSAI-2 intensity and direction scales and flow state.

	M	SD	α	M	SD	α
	Intensity scales			Direction scales		
CSAI-2cog	2.22	0.59	0.77	0.24	1.12	0.84
CSAI-2som	1.63	0.52	0.67	0.62	1.13	0.86
CSAI-2sc	2.70	0.64	0.82	1.03	1.20	0.89
FSS-2	3.49	0.65	0.95			

Results

The CSAI-2d and FSS-2 measures were completed with no missing data. Descriptive statistics in Table I indicate a mean flow state score of 3.49, suggesting that participants experienced some flow characteristics during tennis competition. CSAI-2sc showed the highest intensity rating ($M = 2.70$) of all subscales, and levels of cognitive anxiety ($M = 2.22$) were higher than somatic anxiety ($M = 1.63$). Although all CSAI-2 subscales were perceived as positive in directional interpretation, participants were more facilitative in their interpretations of CSAI-2dsc ($M = 1.03$) than the anxiety subscales (CSAI-2dsom $M = 0.62$; CSAI-2dcog $M = 0.24$).

A strong correlation ($r = 0.75$) between the CSAI-2sc intensity and direction subscales, sharing 56% of the variance, provided support that the confidence scales measure essentially the same state. Further analysis between high- and low-confidence groups using a median split (*Median* = 2.67) showed that the high-confidence group ($n = 28$) interpreted cognitive anxiety as facilitative ($M = 0.60$), and the low-confidence group ($n = 31$) as debilitative ($M = -0.08$). Similarly, somatic symptoms were interpreted as more facilitative in the high-confidence ($M = 0.91$) than in the low-confidence ($M = 0.36$) group. Using an adjusted Bonferroni cut-off for multiple comparisons ($p = 0.025$), independent samples t-tests showed significant differences between confidence groups and cognitive anxiety interpretations, $t(1, 57) = 2.399$, $p = 0.02$, $d = 0.63$, and a non-significant trend for somatic anxiety perceptions, $t(1, 57) = 1.905$, $p = 0.06$, $d = 0.50$.

Relationships between flow, confidence and anxiety symptoms

Meaningful relationships of at least 0.30 and higher (Pedhazur, 1982) between flow and CSAI-2d subscales were found on a global and a subscale level. For the intensity scales, state confidence showed the strongest link with global flow and most flow subscales except time transformation (Table II). CSAI-2sc showed a median correlation of $r = 0.60$

Table II. Correlation coefficients between CSAI-2d subscales and FSS-2 subscales and global flow.

Variables	csb	aam	cg	uf	cth	sc	lsc	tt	ae	Global flow
Intensity scales										
CSAI-2cog	−0.14	−0.06	−0.21	−0.16	−0.10	−0.24	−0.36	0.00	−0.17	−0.21
CSAI-2som	−0.04	−0.22	−0.32	−0.20	−0.04	−0.21	−0.43	0.15	−0.08	−0.20
CSAI-2sc	0.60	0.54	0.61	0.65	0.57	0.62	0.66	0.09	0.53	0.72
Direction scales										
CSAI-2dcog	0.42	0.41	0.42	0.41	0.39	0.52	0.46	0.06	0.28	0.49
CSAI-2dsom	0.28	0.33	0.43	0.33	0.42	0.41	0.47	0.04	0.25	0.43
CSAI-2dsc	0.58	0.51	0.66	0.60	0.56	0.70	0.55	0.24	0.48	0.72

Note. Correlation coefficients ≥ 0.34 are significant at $p \leq 0.01$; csb = challenge-skills balance; aam = action–awareness merging; cg = clear goals; uf = unambiguous feedback; cth = concentration on the task at hand; sc = sense of control; lsc = loss of self-consciousness; tt = time transformation; ae = autotelic experience.

Table III. Standard multiple regression analysis between CSAI-2d subscales and FSS-2.

	Unstandardised coefficients		*Standardised coefficients*		*Unstandardised coefficients*		*Standardised coefficients*	
Variables	*B*	*SE B*	*Beta*	*Significance*	*B*	*SE B*	*Beta*	*Significance*
	Intensity scales				Direction scales			
CSAI-2cog	−6.44	4.83	−0.16	0.19	0.07	3.20	0.00	0.98
CSAI-2som	3.71	6.23	0.07	0.55	−0.70	2.92	−0.03	0.81
CSAI-2sc	25.56	3.42	0.70	0.00	14.39	2.64	0.74	0.00

with flow dimensions, whereas intensity measures of CSAI-2cog and CSAI-2som only had moderate associations with two flow characteristics that were substantially below the median correlations for confidence and flow subscales. All CSAI-2 direction scales displayed significant, meaningful associations with almost all flow characteristics. Again, time transformation appeared to be less strongly linked with directional perception measures of anxiety. For the anxiety and confidence direction scales and flow dimensions median correlations were found to be $r = 0.41$ (CSAI-2dcog), $r = 0.33$ (CSAI-2dsom) and $r = 0.56$ (CSAI-2dsc).

Confidence and anxiety symptoms predicting flow state

Standard multiple regression analysis was carried out with CSAI-2d subscales as independent variables and global flow state as a dependent variable. The regression analysis was conducted twice with CSAI-2d predictor variables for the intensity and the direction scales (Table III). Repeated comparisons in the regression analyses required an adjusted Bonferroni cut-off with a significance level of 0.025. The results further underlined the importance of state confidence for experiencing flow, showing confidence to be a significant predictor of flow state. CSAI-2sc revealed strong beta values of 0.70 for the intensity scale and 0.74 for the direction scale. CSAI-2cog and CSAI-2som intensity scales did not significantly predict flow state. The regression solution for CSAI-2d intensity scales explained 50% (adjusted R^2) of the variance in flow state and 49% (adjusted R^2) of variance in flow based on the directional perception indicators.

Moderator effects between confidence and anxiety symptoms on flow state

Using hierarchical regressions to test for moderating effects (Baron & Kenny, 1986; Frazier, Tix, & Barron, 2004), the equation consisted of flow state as the dependent variable and intensity scales of CSAI-2cog, CSAI-2sc and their interaction (CSAI-2cog × CSAI-2sc) as predictor variables. Separate regression analyses were conducted to test for interaction effects between CSAI-2cog and CSAI-2sc,

Table IV. Testing moderator effects using hierarchical multiple regression.

Step and variable	*B*	*SE B*	*Beta*	*Significance*	R^2
Cognitive anxiety × Confidence interaction					
Step 1					
CSAI-2cog	−2.72	2.18	−0.12	0.22	
CSAI-2sc	16.35	2.18	0.70	0.00	0.52
Step 2					
CSAI-2cog × CSAI-2sc	2.40	1.98	0.12	0.23	0.02
Somatic anxiety × Confidence interaction					
Step 1					
CSAI-2som	−0.50	2.25	−0.02	0.82	
CSAI-2sc	16.59	2.25	0.71	0.00	0.51
Step 2					
CSAI-2som × CSAI-2sc	2.46	1.82	0.13	0.18	0.02

and between CSAI-2som and CSAI-2sc, using standardised z-scores on both occasions. The results in Table IV indicated no significant moderator effects between state confidence and anxiety symptoms. The interaction term explained an additional 2% of the variance in flow state.

Discussion

This study examined the relationship of cognitive anxiety, somatic anxiety and state confidence on flow in tennis competition. The results confirmed a positive relationship between flow and confidence (hypothesis a) and a negative relationship between flow and anxiety intensity (hypothesis b). These results provided further evidence of the relationship between confidence and flow, and corroborates findings of previous studies on flow and anxiety (Jackson et al., 1998; Stavrou & Zervas, 2004). Confidence intensity and direction showed strong correlations with all flow subscales, except time transformation, which adds support for confidence being a key correlate underlying flow state. The regression results (hypothesis c) further corroborated these findings, showing confidence intensity and direction as strong predictors of flow state, whereas anxiety measures revealed no significant results. In contrast to hypothesis d, cognitive and somatic anxiety did not significantly predict flow state, for neither the intensity nor the directional perceptions scale. The presence of anxiety symptoms can have a profound negative or preventative effect on flow (Jackson, 1995; Jackson et al., 1998; Stavrou & Zervas, 2004), but the positive interpretation of anxiety symptoms, as found in this sample, does not necessarily facilitate an optimal flow experience. With regard to confidence, it appears that there were no conceptual differences between confidence intensity and directional perceptions, both being equally strong predictors of flow state, which confirmed that both scales essentially measure the same state (Jones & Hanton, 2001; Jones et al., 1993).

An important finding of this study was the relationship between the directional perception subscales of multidimensional state anxiety and flow. In contrast to the intensity subscale, all three CSAI-2d subscales had moderate-to-strong positive relationships with flow state. The t-test analyses indicated that the high-confidence group, in contrast to the low-confidence group, interpreted anxiety symptoms as more facilitative. These combined findings underline the hypothesis by Hardy and colleagues (1996) that confidence may indeed have a protective function against debilitating anxiety effects. When testing for moderator effects, hierarchical regression analysis revealed no significant results for interactions between confidence and cognitive anxiety, and between confidence and somatic anxiety, on flow state. Following the results of the direct effects of the predictor and moderator variables, the interaction effect only explained an additional 2% of variance in flow state. The moderator effect could have been diminished by the strong direct link between confidence and flow. Baron and Kenny (1986) advocated that it would be preferable to have a zero-order correlation between moderator and predictor and criterion variables in order to "provide a clearly interpretable interaction term" (p. 1174). Baron and Kenny emphasised that a moderator affects direction and strength of the relationship between predictor and criterion variable. The results of Table II provided partial support, indicating a reverse relationship between anxiety intensity and directional perceptions of anxiety with flow state. Cognitive and somatic anxiety varied considerably in terms of directional interpretations (from negative to positive) and strength (from non-significant to significant), supporting that confidence may have had a moderating effect. Although the statistical support was lacking (hypothesis e), the sample size was rather small which lowered the study's power and sensitivity to detect small effects (Hair, Black, Babin, & Anderson, 2010), and therefore limited the probability of finding significant results.

One of the main limitations of this study was the use of a cross-sectional, retrospective design that allowed drawing conclusions based on the collection of post-competition data. In contrast to a longitudinal design, a cross-sectional approach is static and time-bound, assessing the variables at one point in time, which limits the control and conclusions about the effect of independent variables (Baron & Kenny, 1986; Bauman, Sallis, Dzewaltowski, & Owen, 2002). A potential risk of using retrospective introspection is that the performance outcome can affect the participants' perception of their competitive experience (Brewer, Van Raalte, Linder, & Van Raalte, 1991). Performance outcome can become a confounding variable, particularly when assessing ephemeral states like flow or confidence that are closely related to successful and unsuccessful performances. Previous research showed a positive relationship between flow and higher performance levels (Stavrou, Jackson, Zervas, & Karteroliotis, 2007). Similarly, Koehn and Morris (2012) found significant differences in flow state between tennis athletes who won or lost their competition match. Researchers need to be mindful of the effects of performance outcome on flow assessments. Future study designs would benefit from using a short measure of flow (Jackson, Martin, & Eklund, 2008). Jackson and colleagues (2008) validated a nine-item short scale of the FSS-2, which could be completed in competition (e.g., in tennis during changeovers). This would allow for flow assessments during performance and avoid potential negative effects of retrospective introspection. The difficulty would be to have players agree to this procedure in competition, which might be preferred in a training setting.

Future research needs to examine the interaction effects between confidence, anxiety and flow state in young athletes in more detail. A fruitful approach would involve the application of interventions aiming to increase confidence in competition, which, in turn, may have a positive effect on both anxiety interpretations (Hanton et al., 2004) and flow state (Jackson, 1995). Interventions should include specific imagery functions, such as mastery, that are connected to images of being confident and in control, which could provide effective protection against debilitating anxiety interpretations (Hanton et al., 2004) and increase confidence (Moritz, Hall, Martin, & Vadocz, 1996) and flow state (Morris, Spittle, & Watt, 2005). Morris et al. (2005) and Watt, Morris, and Koehn (2010) proposed that the strongest links between flow and other variables need to be reflected in the intervention. An imagery script based on the strongest correlations of this study should emphasise links between confidence, facilitative anxiety interpretations and flow dimensions including clear goals, concentration on the task at hand, sense of control and loss of self-consciousness. The development of future intervention studies holds exciting prospects to further examine the interaction between variables of anxiety, confidence and flow state, which would benefit young athletes, coaches and sport psychologists.

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