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Further examining the relationship between mental toughness and dispositional flow in sport: A mediation analysis

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Keywords

mediation, analysis, sport:, flow, dispositional, toughness, further, examining, relationship, between, mental

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Further Examining the Relationship between Mental Toughness and Dispositional Flow in Sport: A Mediation Analysis

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Abstract

The purpose of the study was to further examine the relationship between mental toughness (MT) and dispositional flow in sport. A sample of 256 athletes (*M* age = 23.65 years, *SD* = 5.43), competing at international (n = 59), national (n = 77), and club/university (n = 120) levels completed questionnaires assessing MT and dispositional flow. A significant and positive correlation was found between MT and dispositional flow (r = 0.50, p < 0.001). Mediation analysis revealed that MT had a significant direct effect on the flow dimensions of challenge-skills balance, clear goals, unambiguous feedback, sense of control and concentration on the task at hand, and significant indirect effects on concentration on the task at hand, sense of control, loss of self-consciousness, action-awareness merging and autotelic experience. Findings suggest that MT has direct and indirect effects on the characteristics of flow, offering new insights regarding optimal human functioning.

Keywords: athlete; autotelic personality; confidence; commitment; mediation analysis

Further Examining the Relationship between Mental Toughness and Dispositional Flow in Sport: A Mediation Analysis

A principle aim for sport psychology practitioners is to assist athletes to reach optimal performance levels and to do so more consistently (Harmison, 2011). In the past decade, research in the area of achieving and maintaining performance excellence has been approached from the perspective of mental toughness (MT; Anthony, Gucciardi, & Gordon, 2016). In acknowledgment of this link to optimal performance, MT was recently defined as the personal capacity to consistently deliver high performance despite varying levels of situational demands (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015). Although there is debate concerning the degree to which MT is inherited and relatively stable (e.g., Hardy, Bell, & Beattie, 2014), or malleable and susceptible to change (e.g., Gucciardi et al., 2015), quantitative and qualitative studies have indicated that MT is somewhat susceptible to development through targeted interventions (Gordon, 2012; Gucciardi, Gordon, & Dimmock, 2009).

The 4C's model (Clough, Earle, & Sewell, 2002) conceptualises MT as a constellation of positive psychological variables, including: *confidence* (the level of belief an individual has in their ability to complete a task); *challenge* (the degree to which individuals view challenges as opportunities to grow rather than as threats); *commitment* (the likelihood that an individual will persist in a task and remain focussed on the task); and *control* (the extent to which individuals believe they have control in their life). Although qualitative studies have identified additional characteristics of MT, such as independence (e.g., Cook, Crust, Littlewood, Nesti, & Allen-Collinson, 2014), sport intelligence (Gucciardi, Gordon, & Dimmock, 2008), performance awareness (e.g., Coulter, Mallett, & Gucciardi, 2010), and concentration (e.g., Thelwell, Weston, & Greenlees, 2005), the majority of emerging characteristics reconcile with the 4C's model proposed by Clough et al. (2002).

Within sport, there is a general consensus that MT contributes to success and progression (e.g., Gucciardi & Hanton, 2016; Hardy et al., 2014) and is an important attribute directing “the process” of consistent high performance (Gucciardi et al., 2015, p. 27). This reference to a *process* of superior performance establishes a conceptual bridge between MT and optimal performance states. When athletes perform towards the upper range of their capabilities, they are likely to experience an optimal psychological state (e.g., Jackson & Kimiecik, 2008). The most studied, and arguably most relevant, optimal psychological state in sport is flow (Csikszentmihalyi, 2002). Indeed, flow is associated with superior – and even peak – performance (Jackson & Roberts, 1992; Swann, Keegan, Crust, & Piggott, 2016). Flow occurs when individuals are challenged to their limits, but perceive their resources to be in proportion with task demands, resulting in an intrinsically rewarding subjective experience characterised by intense concentration, automaticity and a sense of control (Jackson & Csikszentmihalyi, 1999). In addition to these performance-based benefits, a range of positive psychological outcomes have been linked to flow experiences, including intrinsic motivation (Csikszentmihalyi, 2002), self-concept (Jackson, Thomas, Marsh, & Smethurst, 2001), and well-being (Haworth, 1993).

The conceptualisation of flow most commonly adopted in sport features nine dimensions (Jackson, 1996; Jackson & Csikszentmihalyi, 1999). The flow dimensions of *challenge-skills balance* (balance between the high perceived demands and skills in the situation); *clear goals* (clear understanding of goals); and *unambiguous feedback* (receiving instantaneous feedback concerning performance progression) are proposed as the proximal conditions (i.e., involved in its occurrence) or antecedents of flow (Nakamura & Csikszentmihalyi, 2002). The remaining six dimensions are considered to be experiential characteristics of the flow state, including: *concentration on the task at hand* (complete focus on the task); *action-awareness merging* (task absorption or feeling at one with the activity);

sense of control (feeling of control over the performance); *loss of self-consciousness* (concern for the opinion of others disappears); *transformation of time* (a perceptual alteration in the speed at which time passes); and *autotelic experience* (enjoyable and intrinsically rewarding state) (Nakamura & Csikszentmihalyi, 2002).

Flow states are considered to be rare (Jackson, 1992) and elusive (Aherne, Moran, & Lonsdale, 2011), and there is still uncertainty surrounding how flow occurs in sport (Swann, Keegan, Piggott, & Crust, 2012). The interactionist framework forwarded by Kimiecik and Stein (1992) proposes that certain personal (e.g., goal orientation) and situational factors (e.g., self-efficacy) interact with variables in the sport context (e.g., type of sport) to determine the likelihood of a flow experience. Despite the inference towards the role of personal attributes in the occurrence of flow, the preponderance of research in sport has focussed on situational perspectives (e.g., Jackman, Van Hout, Lane, & Fitzpatrick, 2015; Jackson, 1995), although research is beginning to shift towards understanding the dispositional attributes influencing flow (e.g., Koehn, Pearce, & Morris, 2013; Vealey & Perritt, 2015).

While flow is considered to be a universal phenomenon, individuals differ widely in reported flow (Nakamura & Csikszentmihalyi, 2002). Csikszentmihalyi (1975) proposed that the autotelic personality partially explains individual variations in flow frequency. The autotelic personality is recognised as a series of competencies that enhance an individual's capacity to enter, sustain and enjoy flow states (Csikszentmihalyi, 2002). The intriguing prospect of an autotelic personality and the need to identify individual differences affecting the flow experience was highlighted as an avenue for research in some of the earliest work on flow in sport (Kimiecik & Stein, 1992). Despite over two decades of research in sport, an understanding of the proposed autotelic personality and the role of individual differences in the occurrence of flow remains unclear (Swann et al., 2012). For example, in a review of the evidence surrounding dispositional flow in sport, Jackson and Kimiecik (2008) vaguely stated that goal orientation, perceived sport ability, competitive trait anxiety and intrinsic motivation "could make up something resembling an autotelic personality in sport" (p. 392).

Following a systematic review of research investigating flow in elite sport, Swann et al. (2012) stated that "understanding the influence of individual differences in its causation and experience is arguably vital in order to progress scientific understanding of this phenomenon" (p. 816). Further calls to increase understanding of the autotelic personality and explain the manner in which dispositional and situational factors interact to produce flow experiences have been advanced (Jackson, 2014; Jackson & Kimiecik, 2008). Notwithstanding the psychological and performance-based rewards attached to flow experiences (Swann et al., 2012), enhanced understanding of individual differences is integral to inform the implementation of practical, individually-tailored intervention strategies. The importance of achieving peak performance states in sport (e.g., Anderson, Hanrahan, & Mallett, 2014; Harmison, 2011) emphasises the desirability of flow states (Swann et al., 2016), and underlines the value to comprehending the psychological qualities that produce optimal performance states more consistently (Jackson, 2014).

The idea of optimal human functioning forms a conceptual nexus between MT and flow, as there appears to be general agreement on links between performance excellence and both MT (e.g., Anthony et al., 2016; Gucciardi et al., 2015) and flow (e.g., Jackson & Roberts, 1992; Swann et al., 2016). The desirability of consistent peak performance in sport highlights the importance of understanding the relationship between MT and dispositional flow. Theoretically, MT might exert an influence on dispositional flow in a number of ways. The presence of a challenge-skills balance is recognised as "the golden rule of flow" (p. 16) and asserts that flow is likely to occur when the level of challenge and skills extend beyond the individual's normal levels (Jackson & Csikszentmihalyi, 1999). Two facets of MT, namely pursuit of self-improvement and confidence (Cook et al., 2014), could help athletes to achieve this challenge-skills balance by encouraging extension of the challenge pursued and a favourable appraisal of skills, respectively. This is consistent with the proposition that managing the rewarding balance between the "play" of challenge and the "work" of building skill increases the likelihood of flow (Csikszentmihalyi, Rathunde, & Whalen, 1993). Moreover, as prolonged concentration is a hallmark of flow (Dormashev, 2010), the MT capacity to maintain supreme focus on performance goals and refocus following setbacks (e.g., Coulter et al., 2010) could help the initiation and sustainment of flow states. In this context, MT might be a valuable individual difference which assists athletes to initiate, sustain and enjoy flow states more frequently.

Crust and Swann (2013) found a significant positive relationship between MT and dispositional flow (i.e., frequency of flow experiences) in university athletes. The subscales of MT accounted for 50% of the variance in dispositional flow, with the subscales of commitment, challenge and confidence reported as significant predictors. While Crust and Swann (2013) identified significant relations between MT and dispositional flow, these researchers also acknowledge the importance of further work to examine the relationship in more detail. For example, this analysis did not consider the division of flow dimensions (Nakamura & Csikszentmihalyi, 2002), which may be of particular importance given that individuals who experience the proximal conditions of flow more often have an increased tendency to experience the six characteristics of flow (Kawabata & Mallett, 2012).

Recently, a renewed emphasis on replication has emerged in psychological research due to the high failure rate in replication studies (Anderson & Maxwell, 2016). A more thorough investigation of the relationship between MT and flow could examine the direct effect of MT on the proximal conditions of flow, and both the indirect (i.e., via the proximal conditions of flow) and direct effect of MT on the flow characteristics. This would involve mediation analysis, an approach which helps to progress beyond describing antecedents and outcomes and moves towards identifying the processes underlying the occurrence of such outcomes (Ntoumanis, Mouratidis, Ng, & Viladrich, 2015). Based on intersections between the *process* of superior performance and both flow (Swann et al., 2016) and MT (Gucciardi et al., 2015), identifying the direct and indirect effects of MT on dispositional flow could be an important step towards understanding optimal human functioning in sport, and offer recommendations for researchers, coaches, athletes and practitioners as to how dispositional flow can be increased.

The main aim of this study was to ascertain a more precise understanding of the relationship between MT and dispositional flow. Overall, it was hypothesised that; (1) the significant positive relationship between MT and flow established in previous work (Crust & Swann, 2013) would be replicated; (2) MT would have a significant direct effect on the proximal conditions of flow; (3) MT would have a significant indirect effect on the characteristics of flow (i.e., via the proximal conditions of flow); and (4) MT would have a significant direct effect on the characteristics of flow.

Method

Participants

The sample consisted of 256 athletes (*M* age = 23.65 years, *SD* = 5.43; female *n* = 128, male *n* = 128) in Ireland (*n* = 187) and the United Kingdom (*n* = 69), including team (*n* = 193; e.g., hurling, soccer, rugby, cricket) and individual (*n* = 63; e.g., athletics, triathlon, squash) athletes representing 18 sports. All participants had competed in their chosen sport for at least one year (*M* = 12.44 years, *SD* = 6.06), and competed at international (*n* = 59), national (*n* = 77), and club/university (*n* = 120) levels. With respect to the taxonomy of expert performance proposed by Swann, Moran and Piggott (2015), the national and international athletes were categorised as semi-elite (*n* = 71), competitive elite (*n* = 26), successful elite (*n* = 21), and world-class elite (*n* = 2).

Instruments

Dispositional flow. The Dispositional Flow Scale-2 (DFS-2; Jackson & Eklund, 2002) is a self-report instrument designed to evaluate the frequency of flow experiences during one's main sport. Respondents reported the frequency of each item "in general" on a 5-point Likert scale that ranged from 1 (*never*) to 5 (*always*), with a midpoint of 3 (*sometimes*). Each dimension subscale represents four items and example items include: *"I feel I am competent enough to meet the high demands of the situation"* (challenge-skills balance), *'I perform automatically, without thinking too much"* (action-awareness merging), *"I know clearly what I want to do"* (clear goals), *"it is really clear to me how my performance is going"* (unambiguous feedback), *"my attention is focussed entirely on what I am doing"* (concentration on the task at hand), *"I have a sense of control over what I am doing"* (sense of control), *"I am not concerned with how I am presenting myself"* (loss of self-consciousness), *"the way time passes seems to be different to normal"* (time transformation), and *"I really enjoy the experience"* (autotelic experience). Subscale scores can be represented by mean or summed scores, although presenting mean scores allows the results to be interpreted against the instrument measurement scale. A global flow score can be attained by averaging the nine subscales. In accordance with the instrument measurement scale, a high mean score of 4 or 5 supposes that individuals experience these dimensions *frequently* or *always*, and could be reflective of the autotelic personality (Jackson & Eklund, 2004). Evaluations of internal consistency and construct validity established that the DFS-2 is a satisfactory tool to measure global flow and the nine dimensions of flow, with alpha coefficients ranging between 0.78 and 0.90 (Jackson & Eklund, 2002).

Mental toughness. The Mental Toughness Questionnaire-48 (MTQ48; Clough et al., 2002) was used to assess MT and consists of 48 items representing the six subscales of MT. Responses were based on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*), with a midpoint of 3 (*neither agree nor disagree*). Example items include *"challenges usually bring out the best in me"* (challenge), *"I usually find something to motivate me"* (commitment), "*I generally feel in control"* (life control), *"even when under considerable pressure I usually remain calm"* (emotion control), *"I am generally confident in my own abilities"* (confidence in abilities), and *"I usually speak my mind when I have something to say"* (interpersonal confidence). Although the MTQ48 consists of six subscales, a four-subscale measure (i.e., 4C's model of MT) can also be obtained by combining the subscales of confidence in abilities and interpersonal confidence to form a confidence subscale, and integrating life control and emotion control to generate a control subscale. The MTQ48 has been used extensively as a measure of MT and support for the factor structure of the model has been reported (Horsburgh, Schermer, Veselka, & Vernon, 2009). Support for the six-factor model of MT was found in a recent large scale evaluation of the MTQ48, although one subscale (emotion control) exhibited inadequate reliability (Perry et al., 2013). As a result, the authors recommend caution when interpreting results of this subscale, although emotional control is still recognised as an essential conceptual component of MT. The approximate completion time for both instruments was 15 minutes.

Procedure

Ethical approval was received from a university school ethics committee. Initial contact was made via email with gatekeepers (i.e., coaches or administrators) to outline the nature and importance of the present study and request permission to distribute questionnaire packs. The majority of participants (n = 164) completed the paper version and the remainder (n = 92) completed the online version of the questionnaire due to logistical constraints. An information brief outlined the details of the study and individuals provided consent prior to completing the questionnaire. Completion of paper questionnaires took place in a variety of places but most were completed in a changing room after a training session. In the case of the online questionnaire, an online link to the questionnaire was distributed which guided individuals wishing to participate in the study to the questionnaire.

Data Analysis

The data were analysed using SPSS 21. Data were visually screened for missing cases, violations of assumptions of normality, and outliers. Kurtosis, skewness, mean and standard deviation scores were calculated for all study variables. The internal consistency of the MTQ48 and DFS-2 was calculated. This was particularly important in the case of the MTQ48 due to the previously discussed recommendation that an assessment of the internal consistency of the subscales should be undertaken before continuing with data analysis (Perry et al., 2013). Pearson correlations were used to test for relationships between scales and subscales. Independent *t*-tests were conducted to investigate differences in gender and sport types among study variables. Bonferroni adjusted *p*-values were used to correct for multiple comparisons. A MANOVA was performed to test for differences between varying performance levels. A hierarchal linear regression analysis (enter method) was conducted to examine the predictive capacity, if any, of the MT subscales on dispositional flow. A series of simple mediation models were tested by the bootstrapping procedure (Preacher & Hayes, 2004) using the PROCESS model in SPSS (Hayes, 2013). This test examined the direct and indirect effects of MT on the characteristics of flow through the proximal conditions of flow, including challenge-skills balance, clear goals and unambiguous feedback (Nakamura & Csikszentmihalyi, 2002). Bootstrapping involves repeated random sampling observations with replacement from the data set. The significance of indirect effects was determined from

95% confidence intervals calculated using a bootstrapping procedure with 5,000 resamples (Preacher & Hayes, 2004).

Results

No missing data was evident and inspection of Q–Q plots revealed no troublesome outliers. Tests of univariate normality revealed no departure from standard skewness (< 2) or kurtosis (< 2). Descriptive data, the alpha coefficients of the instruments and Pearson bivariate correlations between the scales and subscales of MT and dispositional flow are presented in Table 1. The overall internal consistency of the MTQ48 and the DFS-2 were found to be good ($\alpha = 0.90$ and 0.91, respectively). All subscales presented acceptable internal consistency (i.e. $> \alpha = 0.70$) with the exception of the MTQ48 subscale of challenge ($\alpha = 0.61$), which was deemed to be at the lower end of acceptability. Independent *t*-tests revealed no significant differences between individual and team athletes. A significant gender difference was found with females reporting significantly lower confidence [t (254) = -4.215, $p = .000$, $d = -0.25$]. A MANOVA found significant differences between performance levels on the flow and MT subscales (Wilk's $\Lambda = .003$, $\eta^2 = .097$). Upon inspection of the between-subjects effects, significant differences were found in commitment ($p < 0.001$, $\eta^2 = .070$), challenge-skills balance ($p < 0.05$, $\eta^2 = .028$), clear goals ($p < 0.05$, $\eta^2 = .034$), and unambiguous feedback ($p < 0.05$, $\eta^2 = .034$), but the effect size was small in all cases.

Pearson bivariate correlations were examined to highlight relationships among all variables. Significant positive correlations were found between age and MT ($r = 0.22$, $p < 0.001$), experience and MT ($r = 0.16$, $p < 0.01$), and age and experience ($r = 0.26$, $p < 0.001$). A significant positive correlation ($r = 0.50$, $p < 0.001$) was found between MT and global flow. Positive correlations between global flow and the components of MT were all found to be significant ($p < 0.001$), with the strongest relationship shared between global flow and confidence ($r = 0.48$). With the exception of transformation of time, significant positive correlations ($p < 0.001$) were found between the remaining eight subscales of flow and MT, and the strongest relationship was evident between MT and concentration on the task at hand ($r = 0.48$). Correlations between the variables of both subscales were also examined. The majority of components of MT were positively correlated ($p < 0.01$) with the subscales of flow with the exception of transformation of time, which did not display relations with any of the MT subscales.

[INSERT TABLE 1 ABOUT HERE]

A hierarchal multiple linear regression analysis was conducted to investigate the predictive capacity, if any, of the subscales of MT on dispositional flow. To control for demographic effects, age, gender and competitive level were entered at step one in each analysis using the enter method. The four MT subscales were entered at step two and the global score for dispositional flow (excluding transformation of time) acted as the dependent variable. The included variables significantly predicted flow, $R^2 = 0.28$, F (4, 248) = 22.113, $p < 0.001$, with 25% of unique variance in dispositional flow explained by the MT subscales. Confidence ($\beta = 0.22$, $p < 0.01$) and commitment ($\beta = 0.19$, $p < 0.05$) were significant predictor variables of global flow among the MT subscales.

To further explore the relationship between MT and flow, a series of mediation models were tested by the bootstrapping procedure (Preacher & Hayes, 2004) using the PROCESS model in SPSS (Hayes, 2013). These tests examined whether MT had a direct effect on the characteristics of flow, or if the effect of MT on the characteristics of flow was indirect and mediated by the proximal conditions of flow, as theoretically proposed (Nakamura & Csikszentmihalyi, 2002). To control for demographic effects, age, gender and competitive level were entered as covariates in each analysis. In the first analysis, challenge-skills balance, clear goals and unambiguous feedback (i.e., proximal conditions of flow) were entered as mediators, MT was included as the independent variable, and the characteristics of flow (i.e., action-awareness merging, concentration on the task at hand, sense of control, loss of self-consciousness and autotelic experience) were combined and included as the outcome variable. The results of this mediation model (Figure 1) indicated that MT had a significant direct effect on challenge-skills balance, clear goals, unambiguous feedback and the flow characteristics. The indirect effect of MT on the flow characteristics was found to be significant due to the absence of zero from the bootstrap generated confidence intervals (Preacher & Hayes, 2004). The model was statistically significant, $R^2 = 0 .58$, F (7, 248) = 47.99, $p < 0.001$, and the significant indirect effect of MT on the characteristics of flow was mediated through challenge-skills balance, clear goals and unambiguous feedback.

[INSERT FIGURE 1 ABOUT HERE]

The remaining analyses involved testing a number of mediation models to examine the direct and indirect effects of MT on the individual characteristics of flow (Table 2). Mental toughness was included as the independent variable, challenge-skills balance, clear goals and unambiguous feedback were inserted as mediators, and each characteristic of flow, with the exception of transformation of time, was entered as the outcome variable in five separate mediation models. The results indicated that MT had a significant indirect effect on each characteristic of flow, but only demonstrated a significant direct effect on two of the characteristics of flow, namely concentration on the task at hand ($b = 0.45$, $p < 0.001$) and sense of control ($b = 0.23$, $p < 0.01$). Challenge-skills balance, clear goals and unambiguous feedback were all significant mediators of the significant indirect effects of MT on concentration on the task at hand and sense of control. In the case of the remaining three characteristics of flow, the significant indirect effects of MT were mediated through one or two of the proximal conditions of flow.

[INSERT TABLE 2 ABOUT HERE]

Discussion

The primary aim of this study was to investigate the relationship between MT and flow, and expand upon previous research (Crust & Swann, 2013) by integrating the proposed division of flow dimensions (Nakamura & Csikszentmihalyi, 2002). The significant and positive correlation found between MT and flow (H_1) supports the significant and positive association found previously between these variables (Crust & Swann, 2013). With the exception of transformation of time, almost all of the scales shared a significant positive correlation with the subscales of the other measure, and the strongest correlation was found between MT and concentration on the task at hand. As enhanced focus is a feature of MT (e.g., Cook et al., 2014; Gucciardi et al., 2008), this capacity should help athletes to achieve heightened levels of concentration, a fundamental feature of the flow experience (Dormashev, 2010). The anomalous correlation between transformation of time and MT is in line with previous studies which found a lack of association between this flow dimension and a range of psychological attributes using both state (Jackson, Kimiecik, Ford, & Marsh, 1998; Stavrou, Jackson, Zervas, & Karteroliotis, 2007) and dispositional (Jackson et al., 1998; Koehn et al., 2013) measures of flow.

The subscales of MT significantly predicted global flow and accounted for 25% of the variance, with confidence and commitment identified as significant predictors of flow among the subscales. Commitment concerns the capacity to set goals, be persistent and remain focussed (Strycharczyk & Clough, 2015). Therefore, commitment would appear to be highly beneficial for flow as self-selecting challenging goals and the attainment and maintenance of high concentration levels are proposed qualities of the autotelic individual (Csikszentmihalyi, 2002). Likewise, confidence has demonstrated strong relations with dispositional flow (Koehn et al., 2013), supporting the theoretical proposition that flow occurs as a result of a balance between the challenge of the task and the subjectively perceived levels of skill

(Csikszentmihalyi, 2002). The importance of a positive subjective evaluation of skill highlights the pivotal role of confidence to achieve flow (Jackson & Csikszentmihalyi, 1999; Koehn et al., 2013).

A noteworthy difference between current study findings and previous research in university athletes (Crust & Swann, 2013) was that the challenge subscale failed to significantly predict dispositional flow and two explanations are hypothesised for this result. First, the gender balance observed in this study contrasted with the gender imbalance (males = 77%) in the Crust and Swann (2013) study. Females reported significantly lower confidence in the current study, which could have potentially increased the importance of confidence in this sample. This proposition is supported by evidence indicating that perceptions of skill demonstrate stronger associations with measures of flow than perceptions of challenge (Jackson et al., 1998; Stavrou et al., 2007), and contests the idea that a challenge-skills balance is required for flow (Keller & Landhaußer, 2012). Second, over half of the sample in the present study competed at national or international levels. At high-performance levels, the challenge of competition is generally high and the requisite level of challenge conducive to flow is often present within the activity, thus emphasising the importance of confidence in elite sport (Jackson, 1995). In contrast, the inferior demands present within lower level competitive activities could accentuate the importance of self-creating challenges to induce flow states and increase the relevance of the challenge subscale within these contexts. Potentially, the degree of influence exerted by certain dispositional variables is contingent on the challenge provided by the activity, or lack thereof.

Another distinction between current findings and previous research was that the MT subscales predicted 50% of the variance in dispositional flow in university athletes (Crust & Swann, 2013), which contrasts with the 25% of variance predicted by the MT subscales found in the current study. Sampling differences (i.e., age range, competitive levels, gender proportions), were observed in the current study in comparison to the more homogenous sample of university and primarily male athletes in previous research (Crust & Swann, 2013). As demographic differences in age, gender and competitive level were found, the heterogeneity of the current sample partially impacted on the explanation of variance in dispositional flow. In addition, athletes in the current study reported higher values for the subscales of challenge, commitment and control, but marginally lower values in dispositional flow in comparison to university athletes (Crust & Swann, 2013). The differing complexity of performance environments (e.g., elite versus non-elite), and presence of unique personal factors (i.e., dispositional and situational) might influence the degree of impact exerted by the various components of the interaction between a person and their environment resulting in flow. For example, elite athletes compete in demanding situations which could increase the complexity of the psychosocial interaction (cf. Kimiecik & Stein, 1992) required to experience flow, thus increasing the number of influencing factors. Although speculative, this highlights the need for further research to understand the dynamic and complex interaction between personal and situational factors underpinning flow states in sport (Jackson, 2014; Jackson & Kimiecik, 2008).

In addition to the important task of partially replicating the approach of previous research, this study sought to integrate the division of flow dimensions (Nakamura & Csikszentmihalyi, 2002) to attain a greater understanding of the relationship between MT and dispositional flow. In splitting the nine dimensions to form the proximal conditions and characteristics of flow, Nakamura and Csikszentmihalyi (2002) proposed that satisfying the proximal conditions of flow assists individuals to experience the characteristics of flow. Mental toughness had a significant direct effect on each of the proximal conditions of flow (H_2). The significant direct effect of MT on challenge-skills balance and clear goals is noteworthy as these dimensions have been proposed as factors which “set the stage for flow”

(Jackson, 1996, p. 84). Although unambiguous feedback can be influenced by external factors (e.g., coach feedback), MT has been associated with performance awareness (Coulter et al., 2010), and sporting intelligence (Gucciardi et al., 2008). Arguably, these qualities may be of particular benefit to flow as the development of skills is contingent on the ability to monitor performance feedback (Csikszentmihalyi, 2002). Thus, MT may enhance the capacity of performers to appropriately extract, monitor and manage performance feedback to enhance perceptions of skill, and subsequently increase flow susceptibility.

Notwithstanding the positive effect on the proximal conditions of flow, MT had a significant indirect effect on the characteristics of flow which was mediated by challenge-skills balance, clear goals and unambiguous feedback (H_3). In interpreting this finding, higher MT could enhance flow susceptibility due to the benefits of MT on the proximal conditions of flow. This is congruent with research which found that individuals who experience the proximal conditions of flow are more likely to report the remaining six dimensions of flow (Kawabata & Mallett, 2012). Half of the indirect effects of MT on the characteristics of flow were mediated through challenge-skills balance, the cornerstone of the flow model proposed by Csikszentmihalyi (1975). Significant indirect effects of MT on four of the flow characteristics, most notably sense of control and action-awareness merging, were mediated by challenge-skills balance. Therefore, developing interventions to target the challenge-skills balance dimension could be a particularly fruitful approach to increase dispositional flow, although a greater understanding of this mediated relationship between MT and the flow characteristics is required. For example, little is known about the interaction between challenge and skills in autotelic individuals in sport and whether or not performers can manipulate this “dynamic equation” (Csikszentmihalyi et al., 1993, p. 80) to enhance flow susceptibility, and how this is achieved.

In support of the final hypothesis, MT had a significant direct effect on the flow characteristics (*H_4)*. This is an important finding as it highlights that MT still exerted a unique influence on the characteristics of flow irrespective of the positive effect of the proximal conditions of flow on these characteristics. More specifically, MT had a significant direct effect on two characteristics of flow, namely sense of control and concentration on the task at hand. During flow, athletes typically experience enhanced feelings of control over their thoughts, emotions and performance actions (Swann, Crust, Keegan, Piggott, & Hemmings, 2015). Qualitative studies have reported psychological (Jones, Hanton, & Connaughton, 2007), emotional (Coulter et al., 2010), and environmental (Thelwell et al., 2005) control as features of MT. Consistent with previous research, the ability to maintain control over these psychological and performance-based factors could enhance the likelihood of achieving the sense of control concomitant with flow.

The direct effect of MT on concentration on the task at hand was only marginally lower than the direct effects of MT on each of the proximal conditions of flow, thus emphasising the importance of this characteristic within the flow experience and the strong influence of MT on this dimension. Youth academy soccer coaches referred to the focused and single-minded manner in which players with higher MT pursued their goals (Cook et al., 2014). Although there are discrepancies as to whether concentration on the task at hand is labelled as an antecedent or experiential characteristic of the flow state (Swann et al., 2012), achieving the high levels of task immersion contributing to flow is greatly enhanced by superior concentration capacities (Csikszentmihalyi, 2002). Identifying the direct and indirect effects of MT on the flow dimensions is an important finding which could assist the development of suitable intervention strategies to enhance flow susceptibility. For example, finding that MT had a significant direct and indirect effect on concentration on the task at hand suggests that an approach using complimentary strategies to target this dimension directly and indirectly (i.e., via the proximal conditions) could be beneficial to increase the likelihood of experiencing flow.

Limitations

A number of limitations were present in this study. First, using self-report measures means that responses are susceptible to social desirability. Second, although the majority of questionnaires were completed in paper form, the use of online questionnaires reduces the degree of control over the completion of questionnaires (i.e. alone or with others present). Third, the DFS-2 infers that a dispositional appraisal of typical performance experiences is measured. Further investigations of inter-individual and intra-individual differences could be tested using state measures of flow over repeated performances. Finally, although a causal direction is indicated within the mediation models tested in this study, the use of cross-sectional data prevents the inference of causality. Longitudinal examinations, intervention studies and experimental research designs are required to advance causal understanding and enlighten the influence of dispositional and situational factors on flow occurrence.

Conclusion

Understanding the dispositional factors influencing flow states is a critical area warranting investigation to advance understanding of optimal performance states in sport (Jackson, 2014; Swann et al., 2012). Previous research identified a relationship between MT and dispositional flow (Crust & Swann, 2013). The present study expanded upon previous research by considering the proposed division of flow dimensions (Nakamura & Csikszentmihalyi, 2002) and employing mediation analysis. Mental toughness had a significant direct effect on the characteristics of flow, particularly concentration on the task at hand and sense of control, irrespective of the positive effect of the proximal conditions of flow. A significant indirect effect of MT was also observed on concentration on the task at hand, action-awareness merging, sense of control, loss of self-consciousness, and autotelic experience through the proximal conditions of flow. Identifying the direct and indirect influence of MT on the characteristics of flow is an important finding which could inform future intervention strategies aimed at improving flow susceptibility, an area requiring increased attention in sport (Swann et al., 2012). For example, to achieve a particular flow characteristic, an athlete could employ strategies to directly target that characteristic and compliment this approach with strategies targeted at the proximal conditions of flow to induce indirect benefits. Further research and the utilisation of alternative research designs is required to more precisely understand the processes underlying the relationship between MT and flow in sport, which may provide practical strategies for coaches, athletes and practitioners to enhance flow susceptibility.

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Tables and figures

Table 1: Descriptive statistics, internal consistency co-efficient and bivariate correlations for study variables.

	M	*SD*	Kurt.	Skew.	α	Csb	Aa	Cg	Uf	Con	Sc	Lsc	Tt	Ae	Flow	Cha	Com	Cont	Conf	Mt
Challenge-skills balance	3.73	0.56	-0.16	-0.04	0.76		.48	.45	.40	.46	.60	.30	.18**	.44	.72	.33	.39	.38	.39	.45
Action-awareness merging	3.65	0.58	-0.10	0.05	0.75			.30	.37	.32	.44	.29	.24	.20**	.62	.28	.24	.24	.27	.30
Clear goals	4.09	0.57	-0.33	-0.40	0.73				.42	.49	.44	.25	.06	.44	.67	.30	.44	.33	.30	.40
Unambiguous feedback	3.95	0.70	-0.33	-0.39	0.85					.38	.43	.31	.18**	.32	.67	.23	.27	.27	.25	.30
Concentration on the task at hand	3.75	0.63	-0.43	0.36	0.79						.64	.34	.11	.35	.70	.35	.43	.45	.39	.48
Sense of control	3.75	0.58	-0.27	0.91	0.76							.37	.16*	.38	.76	.30	.37	.38	.39	.43
Loss of self-consciousness	3.29	0.86	0.05	-0.30	0.80								.18**	.21**	.61	.18**	.10	.24	.33	.27
Transformation of time	3.36	0.77	-0.40	0.17	0.81									.20**	.44	.00	-.08	-.03	.07	.00
Autotelic experience	4.23	0.61	-0.83	1.39	0.80										.60	.34	.34	.24	.26	.34
Global flow	3.76	0.41	-0.14	0.17	0.91											.39	.41	.42	.46	.50
Challenge	3.69	0.42	-0.16	0.21	0.61												.56	.63	.58	.76
Commitment	3.74	0.50	-0.12	-0.53	0.79													.66	.57	.82
Control	3.40	0.47	0.15	-0.48	0.71														.69	.89
Confidence	3.49	0.48	-.07	-0.30	0.76															.88
Mental toughness	3.56	0.40	0.12	-0.51	0.90															

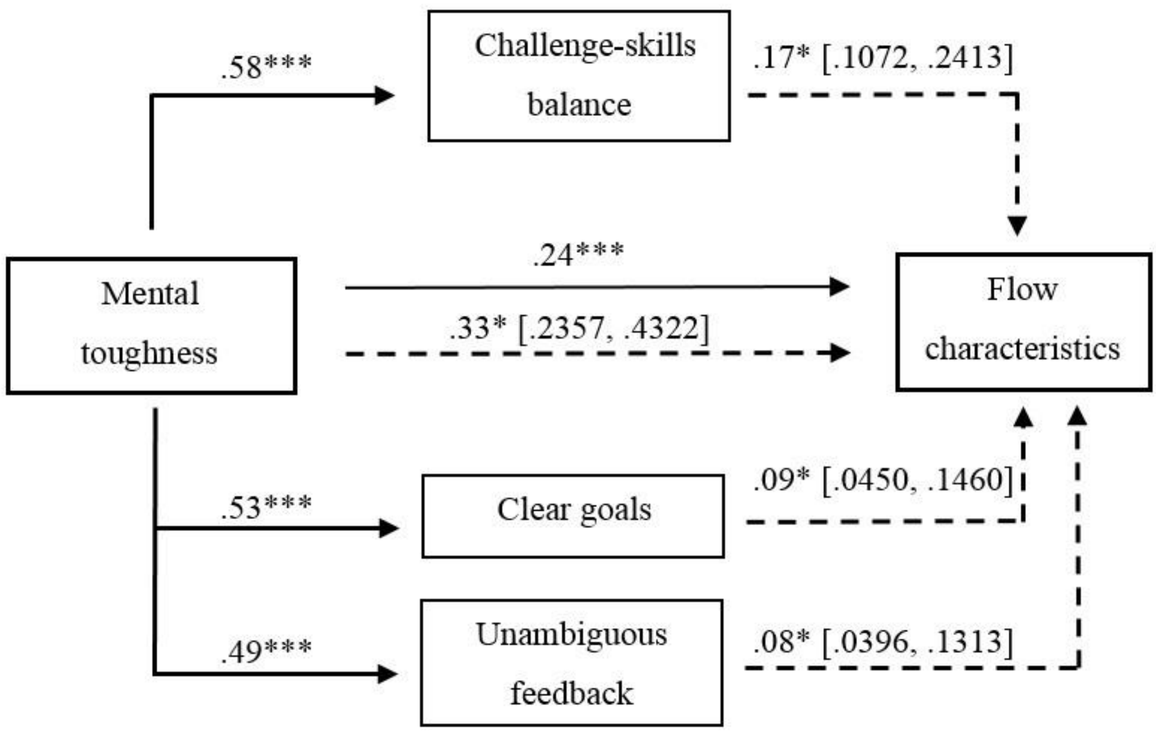
Note: Csb = challenge-skills balance. Aa = action-awareness merging. Cg = clear goals. Uf = unambiguous feedback. Con = concentration on the task. Sc = sense of control. Lsc = loss of self-consciousness. Tt = transformation of time. Ae = autotelic experience. Cha = challenge. Com = commitment. Cont = control. Conf = confidence. Mt = mental toughness. All correlations $r \geq 0.22$ were statistically significant at the level of $p < 0.001$. ** $p < 0.01$ * $p < 0.05$. Underlined correlations were not statistically significant.

Table 2: Direct and indirect effects of mental toughness on the characteristics of flow (concentration on the task at hand, action-awareness merging, sense of control, loss of self-consciousness, autotelic experience) through the proximal conditions of flow (challenge-skills balance, clear goals, unambiguous feedback).

	Direct effect	Indirect effect	Bias corrected 95% confidence intervals	
			Lower	Upper
Concentration on the task at hand (OV)	*F* (7, 248) = 22.99***; R^2 = 0.39			
Mental toughness (IV)	0.45***	0.33*	.2172	.4603
Challenge-skills balance (M)	0.19**	0.11*	.0326	.2051
Clear goals (M)	0.30***	0.16*	.0694	.2809
Unambiguous feedback (M)	0.12*	0.06*	.0107	.1318
Action-awareness merging (OV)	*F* (7, 248) = 13.89***; R^2 = 0.28			
Mental toughness (IV)	0.11	0.30*	.1907	.4387
Challenge-skills balance (M)	0.34***	0.20*	.1122	.3129
Clear goals (M)	0.04	0.02	-.0621	.1118
Unambiguous feedback (M)	0.16*	0.08*	.0259	.1598
Sense of control (OV)	*F* (7, 248) = 30.74***; R^2 = 0.46			
Mental toughness (IV)	0.23**	0.39*	.2897	.5330
Challenge-skills balance (M)	0.42***	0.24*	.1534	.3638
Clear goals (M)	0.14*	0.07*	.0093	.1569
Unambiguous feedback (M)	0.16***	0.08*	.0324	.1465
Loss of self-consciousness (OV)	*F* (7, 248) = 7.26***; R^2 = 0.17			
Mental toughness (IV)	0.21	0.29*	.1305	.4809
Challenge-skills balance (M)	0.21	0.12	-.0202	.2733
Clear goals (M)	0.08	0.04	-.0644	.1618
Unambiguous feedback (M)	0.26**	0.13*	.0393	.2550
Autotelic experience (OV)	*F* (7, 248) = 14.50***; R^2 = 0.29			
Mental toughness (IV)	0.19	0.35*	.2477	.4796
Challenge-skills balance (M)	0.27***	0.16*	.0792	.2707
Clear goals (M)	0.28***	0.15*	.0437	.2751
Unambiguous feedback (M)	0.09	0.04	-.0057	.1082

Note: With respect to the direct effects, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. With respect to the indirect effects, * indicates a significant effect due to the absence of zero from the bootstrap generated confidence intervals (Hayes & Preacher, 2004). IV = independent variable; M = mediator; OV = outcome variable.

Figure 1: Statistical model representing the results of the multiple mediation analysis examining the direct and indirect effects of mental toughness on dispositional flow.



Note: The bias-corrected 95% confidence intervals are included in parentheses. The unbroken lines indicate the direct effect of MT and the broken lines indicate the indirect effect of MT. With respect to the direct effects, *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. With respect to the indirect effects, * indicates a significant effect due to the absence of zero from the bootstrap generated confidence intervals (Hayes & Preacher, 2004).