A Test of Multidimensional Anxiety Theory With Male Wheelchair Basketball Players

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The purpose of the present field study was to examine the predictions of Multidimensional Anxiety Theory (MAT; Martens et al., 1990) with elite male wheelchair basketball players. Thirty-seven elite male wheelchair basketball players completed the CSAI-II prior to each of three tournament games. Results were analyzed using the intraindividual procedures recommended by Sonstroem and Bernado (1982), and separate polynomial trend analyses were used to test the predictions of MAT. Results did not provide statistical support for MAT in that there were no reliable trends between cognitive state anxiety, somatic state anxiety, state self-confidence, and basketball performance. Avenues for future research are suggested.

During the past decades, the inverted-U hypothesis (Yerkes & Dodson, 1908) has been a dominant explanation used to describe the relationship between anxiety and performance in sports. It proposes that performance will be poor at very low levels of anxiety, optimal at an intermediate level of anxiety, and then become progressively worse as anxiety increases beyond an optimal level. Despite its intuitive appeal (Martens, 1974), a number of authors recently have criticized this hypothesis from a variety of viewpoints.

Conceptually, the inverted-U hypothesis does not take into account theory and research which support the distinction between cognitive and somatic anxiety (Borkovec, 1976; Martens, Burton, Vealey, Bump, & Smith, 1990; Morris, Davis, & Hutchings, 1981). Methodologically, when validating the inverted-U hypothesis, it is necessary to have low, medium, and high anxiety conditions. Early studies testing the inverted-U hypothesis failed to meet this criterion (Martens, 1974). Another methodological problem when testing any of the theories examining the anxiety-performance relationship is the operational definition of performance. For some athletes, scoring 20 points in a basketball game might be considered successful while for another athlete, based on past results, this might be considered a failure. Krane (1992) argues that “performance should be based solely on an athlete’s own achievements and not be influenced by extraneous factors” (p. 75).
With the exception of the studies performed by Sonstroem and Bernardo (1982), Gould, Petlichkoff, Simons, and Vevera (1987), Burton (1988), and Krane (1990), rarely has the inverted-U theory been tested in this manner.

Statistically, studies testing the inverted-U hypothesis have relied on between-subjects comparisons and have not taken into account individual differences in anxiety. By using between-subjects comparisons, individual differences have been obscured. For example, a score of 18 on the somatic scale of the Competitive State Anxiety Inventory-II (CSAI-II) (Martens et al., 1990) for one individual might be considered high whereas for another individual it might be low. Support for the inverted-U has been reported in studies using intraindividual statistics (Burton, 1988; Gould et al., 1987; Sonstroem & Bernado, 1982) with the exception of a study performed with soccer players by Krane (1990).

In studies using intraindividual designs, an athlete’s level of anxiety is considered high or low based on the athlete’s average anxiety level. A mean somatic state anxiety is computed for each athlete and then standard scores are obtained for each of the somatic state anxiety scores reported by an athlete to ascertain if an athlete is above or below his or her typical level of somatic state anxiety. Performance is also standardized in such a manner. Performance is based on an athlete’s ability, and the use of intraindividual procedures ensures that an individual’s performance becomes relative to a player’s respective average. Although the use of such procedures support the inverted-U hypothesis, Burton (1988) and Krane (1990) also have demonstrated a negative relationship between cognitive state anxiety and performance suggesting that anxiety is multidimensional and that cognitive and somatic state anxiety may have different effects on performance depending on the nature of the task.

Although the concepts of anxiety (Vealey, 1990) have received considerable attention with able-bodied athletes, very little attention has been paid to this concept in sport for individuals with physical disabilities. The research examining this question in wheelchair sports focuses mainly on between groups comparisons (wheelchair athletes vs. able-bodied athletes) and within groups comparisons (wheelchair athletes vs. wheelchair nonathletes) using the tension subscale of the Profile of Mood States (POMS) (McNair et al., 1971). Different studies suggest that wheelchair athletes may be similar to able-bodied athletes with regard to self-report levels of tension (Goodbrand, 1987; Henschen, Horvat, & French, 1984; Horvat, French, & Henschen, 1986; Horvat, Roswal, & Henschen, 1991), state and trait anxiety (Henschen et al., 1984). Studies that have compared wheelchair athletes to wheelchair nonathletes with regards to self-report levels of tension have produced equivocal results (Canabal, Sherrill, & Rainbolt, 1985; Greenwood, Dzewaltowski, & French, 1990; Monazzi, 1982; Paulsen, French, & Sherrill, 1990). Finally, a more recent study by Henschen, Horvat, and Roswall (1992) has demonstrated that players who were selected for the United States wheelchair basketball paralympic team scored lower on tension subscale of the POMS than the players who were not selected.

In summary, research on the topic of anxiety in wheelchair sports is limited. The suggestion that wheelchair athletes may be similar to able-bodied athletes with respect to self-report levels of anxiety should be interpreted with caution. Only the study by Henschen et al. (1984) has compared state and trait anxiety of wheelchair athletes to able-bodied athletes. In addition, it should be noted that most of the research examining anxiety in wheelchair sports has used the tension
subscales of the POMS. A comparison between the items found in this scale and the items found in the Competitive State Anxiety Inventory-II (CSAI-II) (Martens et al. 1990) suggests that the tension subscale of the POMS is very similar to somatic state anxiety. Thus, it would seem that past studies examining anxiety in wheelchair sports have focused on somatic anxiety and not cognitive anxiety. Furthermore, very little research has examined the relationship between anxiety and wheelchair performance. A study by Patrick (1986) suggested that the higher level of competitive state anxiety experienced by integrated wheelchair adolescents may have been detrimental to learning and performing tennis skills. However, none of the studies reviewed above have investigated the relationship between cognitive state anxiety, somatic state anxiety, state self-confidence, and performance for wheelchair athletes. According to Goodling and Asken (1987) and Reider (1979), many basic research issues remain to be examined in sports for individuals with physical disabilities. If the implementation of sport psychology techniques advocated by Asken and Goodling (1986), Asken (1991), and White and Zientek (1991) with elite wheelchair populations are to be undertaken, researchers need to address relevant sport psychological theories (see Crocker, 1992).

One relevant sport psychological theory is Multidimensional Anxiety Theory (MAT, Martens et al., 1990). According to this theory, performance can be predicted by three separate psychological factors namely cognitive state anxiety, state self-confidence, and somatic state anxiety. Cognitive state anxiety is defined as “negative expectations and concerns about oneself, the situation at hand, and potential consequences” (Morris et al., 1981, p. 581). A high level of cognitive state anxiety alters the focus of an individual from a task to a more self-evaluative focus. Thus, it is predicted that a high level of cognitive state anxiety should be associated with poor performance (Hypothesis 1). State self-confidence refers to the degree of certainty athletes possess about their ability to be successful in an upcoming competition. MAT predicts that state self-confidence should be positively related to a player’s performance (Hypothesis 2). Finally, this theory is interwoven with the inverted-U hypothesis in that it, too, predicts a curvilinear relationship between somatic state anxiety and performance. Performance should be poor at very low levels of somatic state anxiety, optimal at an intermediate level of somatic state anxiety, and then become progressively worse as somatic state anxiety increases beyond an optimal level (Hypothesis 3). Support for MAT has been equivocal with able-bodied athletes. Studies using between subjects designs have failed to find support for the theory (Gould, Petlichkoff, & Weinberg, 1984; Karteroliotis & Gill, 1987; Krane & Williams, 1987; Maynard & Howe, 1987; McAuley, 1985; Taylor, 1987), whereas studies using an intraindividual design have yielded better support for the theory (Barnes, Sime, Dienstbier, & Blake, 1986; Burton, 1988; Gould, Petlichkoff, Simons, & Vevera, 1987; Krane, 1990; Rodrigo, Lusiaro, & Pereira, 1990).

Although the potentially debilitating effects of anxiety is well-documented for able-bodied athletes participating in various sports, very little is known about how anxiety effects the performance of wheelchair athletes. Research efforts examining athletes with physical disabilities cannot simply assume that theories which apply to able-bodied athletes will readily apply to physically challenged athletes (Asken & Goodling, 1986). For example, Sonstroem and Bernado (1982) tested the inverted-U hypothesis with female able-bodied basketball players. Using intraindividual analyses, they reported a curvilinear relationship between basket-
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ball performance and state anxiety as measured by Spielberger's (1970) state anxiety inventory. In Canada, more than 1,000 individuals participate in wheelchair basketball (Brasile, 1992). It is unclear if the results of this study could apply to wheelchair basketball players. Many wheelchair athletes have had their spinal cord injured in accidents and this has altered some of their physiological responses (Curtis, 1981; Madorsky & Curtis, 1984). Another difference between able-bodied athletes and athletes with physical disabilities is that the latter athlete has had to learn to cope with a major life trauma. Because of these factors, it is possible that anxiety might not influence wheelchair athletes in the same manner as able-bodied athletes. Research is warranted to verify the predictions of MAT as they apply to wheelchair athletes.

The purpose of the present study was to test the predictions of MAT with wheelchair basketball players. Furthermore, the present study used the recommendations proposed by various authors in order to test the inverted-U hypothesis and MAT. First, three distinct levels of low, moderate, and high cognitive and somatic state anxiety and state self-confidence were created for each subject (Martens, 1974). Second, intraindividual analyses were performed (Burton, 1988). Third, performance measures were obtained in real competitive situations (Burton, 1988). Finally, the stipulation that season-long standardized performance measures should be used (Burton, 1988) was partially fulfilled. In this study, performance was evaluated at the National Canadian Wheelchair Basketball Championship for elite male wheelchair basketball players across three games. Although the wheelchair tournament does not fit the fourth criteria perfectly, it provided an opportunity to obtain an adequate sample and the minimum amount of games required for intraindividual analyses (Sonstroem & Bernado, 1982).

Method

Subjects

Thirty-seven elite male wheelchair basketball players ranging in age from 25 to 40 years old from one of six provincial teams served as subjects in the present field study. The number of respondents by classification were as follows: Class 1 (N = 6), Class 1.5 (N = 3), Class 2 (N = 13), Class 2.5 (N = 1), Class 3 (N = 7), Class 4 (N = 7). Subjects were participating in the National Wheelchair Basketball Tournament. Initial permission to conduct the study was obtained from the tournament organizing committee and the respective head coaches of the different provincial teams.

Questionnaire

The Competitive State Anxiety Inventory-II (CSAI-II) (Martens et al., 1990) is a self-report inventory consisting of three 9-item subscales measuring cognitive state anxiety, somatic state anxiety, and state self-confidence in competitive situations. Each of the 27 items of the CSAI-II is rated on a 4-point Likert format from “not at all” to “very much so.” The CSAI-II was used to assess wheelchair basketball players’ cognitive state anxiety, somatic state anxiety, and state self-confidence prior to each wheelchair basketball game. Although the reliability and validity of the questionnaire has been established for athletic able-bodied populations (for more details, see Martens et al., 1990), such psychometric information is lacking for wheelchair basketball players.
Procedures

Players who agreed to participate in the study completed the CSAI-II 20 to 35 minutes prior to each of three tournament games. Antisocial desirability instructions were placed at the beginning of each questionnaire (Martens et al., 1990, p. 181). All games were videotaped and game statistics were calculated by analysis of the videotape. Game statistics included: rebounding, assists, total points scored, steals, personal fouls, turnovers, shooting percentage (field goal, three-point field goal, and foul shooting percentage combined), blocked shots, and time played.

Performance Measure

Performance was evaluated using a modified version of the formula provided by Sonstroem and Bernado (1982). The formula was developed because it was recognized that although total points is frequently believed to be the best measure of basketball performance, scores may be dependent upon a number of factors such as the position played or type of offensive system used. The formula was developed to reflect overall playing ability. Basketball Performance = Shooting % (TP + REB + AS + ST + BK) - PF - TO + 15 where shooting % = field goal percentage, three-point field goal percentage, and foul shooting percentage combined; TP = total points scored in the game; REB = rebounds; AS = assists; ST = steals; BK = blocked shots; PF = personal fouls (a value of 7 was assigned when fouling out of a game); TO = turnovers; 15 = constant to assure positive scores. The difference between the present formula and the one presented by Sonstroem and Bernado is that blocked shots were added and the constant was raised to 15 instead of 10.

Intraindividual Analyses

An intraindividual design was used in the present study. In this type of study, a mean score is computed for each of the CSAI-II subscales and for the performance measure for each athlete. Intraindividual standard scores are then obtained for the CSAI-II subscales score and the performance measure. By following this procedure, a CSAI subscale score for a particular athlete on cognitive state anxiety, somatic state anxiety, state self-confidence, and the basketball performance measure becomes relative to each player’s respective average.

Means and standard deviations for cognitive and somatic state anxiety, state self-confidence, and basketball performance were computed for each of the wheelchair basketball players. For the purpose of polynomial trend analyses, intraindividual standard scores were created for cognitive and somatic state anxiety and state self-confidence. Basketball performance was standardized using T-scores for each of the players. The data points of 31 wheelchair basketball players were included in the polynomial trend analysis. Six players failed to play the required three games and were excluded from the analyses.

Results

Cronbach's alpha coefficients were computed to determine the internal consistency of each of the three subscales of the CSAI-II across elite male wheelchair basketball players. Alpha coefficient for the CSAI-II subscales were as follows:
cognitive state anxiety (alpha = .76), somatic state anxiety (alpha = .85), state self-confidence (alpha = .89), all indicating acceptable internal consistency.

To examine if three distinct levels of CSAI-II subscales scores were obtained in the present experiment, each wheelchair basketball player’s CSAI-II subscale scores were reordered independently from lowest to highest. According to Sonstroem and Bernado (1982), it does not matter which game created an elevated state anxiety level as long as three distinct levels of state anxiety are obtained. Repeated-measures analyses of variance were used to determine if differences existed among levels (low, medium, high) of each subscale. Results indicated three distinct levels of cognitive state anxiety with $F(2,74) = 63.93, p < .01$; as well as somatic state anxiety with $F(2,74) = 84.83, p < .01$; and self-confidence with $F(2,74) = 58.69, p < .01$ for wheelchair basketball players. Scheffe post hoc tests revealed that each of the three levels for cognitive and somatic state anxiety and state self-confidence differed from each other ($p < .01$) for elite male wheelchair basketball players. Table 1 contains the means for low, moderate, and high cognitive and somatic state anxiety and state self-confidence for elite male wheelchair basketball players.

In order to examine the possibility that the anxiety-performance relationship was confounded by task difficulty, the degree of task difficulty associated with the anxiety categories was examined using Friedman two-way analysis of variance by ranks for each of the CSAI-II subscales for wheelchair basketball players. Final tournament position (rank values from 1 to 8) for opponent teams were assigned to low, moderate, and high categories of cognitive state anxiety, somatic state anxiety, and state self-confidence respectively. Results revealed nonsignificant ($p > .05$) chi-square values for wheelchair basketball players indicating that the caliber of opponents was similar across the levels of cognitive state anxiety, somatic state anxiety, and state self-confidence.

Consistent with the procedures used by Burton (1988), Gould et al. (1987), and Krane (1990), three separate polynomial trend analyses were computed to test for linear and curvilinear relationships between each of three standardized CSAI-II subscales scores and intraindividual basketball performance. Contrary to the predictions of MAT, the data did not reveal any significant negative linear trend between cognitive state anxiety and performance ($r = .23, p > .05$). The quadratic trend between cognitive state anxiety and performance also was nonsignificant.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Mean and Standard Deviations for Low, Moderate, and High Cognitive State Anxiety, Somatic State Anxiety, and State Self-Confidence for Elite Male Wheelchair Basketball Players</th>
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<tr>
<td></td>
<td>Low</td>
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<td>Cognitive anxiety</td>
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<td>Somatic anxiety</td>
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<td>Self-confidence</td>
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(t = −.25, p > .05). The data did not show any quadratic trend between somatic state anxiety and performance (t = −.20, p > .05). The linear trend between somatic state anxiety and performance also was nonsignificant with t = .20, p > .05. Finally, the data did not reveal any positive linear trend between state self-confidence and performance (t = .18, p > .05). The quadratic trend between state self-confidence and performance also was nonsignificant (t = −.19, p > .05).

Discussion

The purpose of the present study was to test the predictions of MAT with elite male wheelchair basketball players. MAT predicts that a negative relationship will occur between cognitive state anxiety and performance, a quadratic relationship will exist between basketball performance and intraindividual somatic state anxiety, and that a positive relationship between state self-confidence and performance will occur. Consistent with the procedures used by Burton (1988), Gould et al. (1987), and Krane (1990), separate polynomial trend analyses were computed to examine the relationship between the CSAI-II subscales and standardized basketball performance scores. The results of the present investigation failed to support the hypotheses of MAT.

Failure to find significant relationships between the CSAI-II subscales and performance could be attributed to methodological or theoretical reasons. From a methodological point of view, it is possible that initial ratings on the CSAI-II were not reflective of the changing nature of a basketball game. The sport of basketball is subject to rapid shifts in scoring. For example, if a team scores 16 points in a row early in the game, changes in any or all three CSAI-II subscales are likely to occur. A player may feel more confident and less worried because of the team’s apparent advantage. If a player is asked to come off the bench, the cognitive state anxiety, somatic state anxiety, and state self-confidence reported prior to the game might have fluctuated because of a player’s adjusted perceptions and expectancies.

A recent study with able-bodied subjects by Caruso et al. (1990) suggests that the idea that cognitive state anxiety, somatic state anxiety, and state self-confidence can fluctuate during competition is plausible. They found that when subjects received positive feedback during simulated competition, cognitive state anxiety decreased and state self-confidence increased. When subjects received negative feedback, cognitive state anxiety increased and state self-confidence decreased. Caruso et al. (1990) also failed to confirm the predictions of MAT.

Another potential reason for failing to corroborate the predictions of MAT is that the CSAI-II essentially measures the intensity of symptoms that are purported to indicate the presence of anxiety. Jones and Swain (1992) have suggested that researchers also need to measure athletes’ interpretation of those symptoms in terms of whether they are beneficial or detrimental in relation to upcoming performance. Empirical support for this distinction has been provided by Jones, Hanton, and Swain (1994) using able-bodied elite and nonelite swimmers.

An additional consideration for the lack of theoretical confirmation of results with reference to MAT is the notion that wheelchair athletes may have developed coping skills due to the severity of their injury (Cox & Davis, 1992). The coping skills may have transferred to the sport environment. This suggestion could be verified by performing in-depth interviews with wheelchair athletes in order to
find out if wheelchair athletes are really using their coping skills during a competition. However, if wheelchair basketball players do use such coping skills as suggested by Cox and Davis (1992), cognitive state anxiety, somatic state anxiety and state self-confidence could be altered in some way either before or during the game. The propositions of MAT, then, may not apply to this population because they potentially have learned to use the necessary coping skills in a variety of dynamic environments, thus, negating or altering the prediction of any theory espousing a relationship between affective disposition and performance.

From a theoretical point of view, MAT suggests that cognitive state anxiety, somatic state anxiety and state self-confidence are independent factors and predicts that each of these components effects performance differentially. This theory does not take into account the interaction between cognitive and somatic anxiety and its effect on performance. A model proposed by Fazey and Hardy (1988), based on catastrophe theory (Thom, 1975), suggests that the combined effects of cognitive state anxiety and somatic state anxiety better explain the relationship between anxiety and performance. Catastrophe theory recently has been tested by Krane (1990) and Hardy and Parfitt (1991), and the results of these studies appear to support the theoretical predictions of this particular theory.

Future studies should attempt to verify if the combination of cognitive anxiety and somatic anxiety provide a better explanation of the anxiety-performance relationship for both able-bodied and wheelchair basketball players. According to Gould and Krane (1992), catastrophe theory is complex but its potential as a viable explanation of the anxiety-performance relationship outweighs the efforts needed to test it. Future studies examining the anxiety-performance relationship might consider how wheelchair athletes interpret anxiety, and studies examining team sports also should take into account the effect of success and failure within a game to determine how these two factors relate to the different CSAI-II subscales.

References


Notes

1In order to examine differences among levels of functional classification, a MANOVA was performed with the three CSAI-II subscales as dependent variables. For the purpose of this analysis, athletes classified as 1.5 or 2.5 were removed from the analysis because of their small number. Results of this analysis indicated that the main effect of level of functional classification was nonsignificant.

2Because some of the participants were French, a French version of the CSAI-II was created using back translation procedures (Brislin, 1981). Alpha coefficients were quite similar to the ones found for the English participants. For the sake of simplicity, the alpha coefficients presented here include both English and French wheelchair basketball players.