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Cognitive Anxiety and Mental Errors in Sport

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This investigation tested the relationship between level of cognitive anxiety and degree of mental errors in a sport setting. Subjects were female high school varsity softball players. The dimensions of cognitive anxiety, somatic anxiety, and self-confidence were assessed by the Competitive State Anxiety Inventory-2 (CSAI-2). Coaches evaluated mental errors during game play by ratings on a 10-point bipolar scale. Final subject selection was determined by dichotomizing individuals who scored lower on the scale (1–4) and higher on the scale (7–10). Analysis of variance yielded a single significant main effect which indicated that the two mental-error groups differed in cognitive anxiety. This supports the major prediction tested. Discussion centers on the apparent benefits of investigating variables more intimately associated with the attentional/cognitive disruption process versus focusing solely on objective sport outcome.

A phenomenon that holds intrigue for sport psychologists and athletes alike is the increase in mental errors during athletic contests as opposed to practice. The most commonly accepted explanation for those errors is the increase in anxiety that occurs as a result of the highly evaluative nature of the competitive setting as compared to practice conditions.

Contemporary theorists view the construct of state anxiety to be at least bidimensional in nature (Bird & Cripe, 1986; LeUnes & Nation, 1989; Liebert & Morris, 1967; Martens, Burton, Vealey, Bump, & Smith, 1983; Schwartz, Davidson, & Goleman, 1978). The components of cognitive and somatic state anxiety are the two most frequently investigated dimensions. Cognitive anxiety refers to feelings of worry or apprehension while somatic anxiety reflects heightened physiological activation. Therefore, in an attempt to understand the relationship between elevations in state anxiety and decrements in motor performance, researchers have generally adopted one of two perspectives—physiological or cognitive. For instance, employing a unidimensional rather than a multidimensional framework, Weinberg and his associates conducted a series of studies designed to investigate the connection between neuromuscular patterning and identifiable levels of global state anxiety (Weinberg, 1978; Weinberg & Hunt, 1976; Weinberg & Ragan, 1978).

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Concurrently, others theorized that increases in state anxiety cause attentional disruptions or biases in the information the performer receives from the environment (Landers, 1980; Schmidt, 1982). Thus they attempted to explain performance decrements that occur under conditions of elevated anxiety on the basis of selection errors that occur prior to information processing. As such, they tended to focus on processes through which information is taken into the human system. In essence then, such explanations are based on cognitive or attentional disruptions that occur as a consequence of elevated state anxiety and that then serve to bias or distort environmentally based information.

If the cognitive/attentional disruption explanation has merit, one could assume the existence of a large body of research evidence to support it. There are general theoretical discourses (e.g., Easterbrook, 1959; Kahneman, 1973), and some laboratory evidence on motor skills is also supportive (e.g., Landers, 1982; Reis & Bird, 1982); however, there is little field evidence.

For instance, in studies of golf performance and cognitive anxiety, sometimes no significant relationships were found (McAuley, 1985) and sometimes the predicted relationships appeared in one situation but not in another (Martens et al., 1983). Similarly, in an investigation of intercollegiate wrestlers (Gould, Petlichkoff, & Weinberg, 1984), a very marginal relationship between cognitive anxiety and performance was evidenced in only one of two matches. Furthermore, in a more recent investigation of pistol shooting performance (Gould, Petlichkoff, Simons, & Vevera, 1987), there was no indication of the proposed relationship between cognitive anxiety and sport performance. However, Gould et al. (1987) did identify several potential methodological problems that could account for the current status of the field-based literature.

One possibility is that the most favored assessment instrument, the Competitive State Anxiety Inventory–2 (CSAI–2) (Martens et al., 1983), may lack either sufficient construct or predictive validity relative to athletic performance. However, the CSAI–2 has been shown to validly measure three constructs thought to be associated with competitive state anxiety: cognitive anxiety, somatic anxiety, and self-confidence. Therefore, perhaps if construct validity is present, problems in predictive validity may be due to methodological weaknesses rather than psychometric properties inherent in the CSAI–2.

If this is the case, then a major issue of concern is the manner in which sport performance has usually been measured in field settings. In some circumstances the opponents varied (wrestling); in others the terrain and situation demand characteristics varied (golf). However, even when task demands were manipulated so as to remain constant (pistol shooting), the predicted relationship between cognitive anxiety and athletic performance was not demonstrated. Should the only conclusion be that the relationship is nonexistent, or at the very best dismal, or is there still room for some optimism? Apparently there is. As discussed more fully below, Burton's (1988) recent findings on swimmers' anxiety, using an intraindividual rather than an interindividual approach, indicates a sound basis for such optimism.

The current investigation also used an intraindividual methodology to explore the cognitive anxiety/sport performance process in a field setting. In addition, rather than the focus being on objective sport outcome, this investigation attempted to explore that relationship by studying a cognitively based variable, mental errors, and its association with level of cognitive anxiety. Previous theorizing (e.g., Martens et al., 1983; Morris, Davis, & Hutchings, 1981; Wine,

1971, 1980) would suggest that such cognitive worry or cognitive anxiety should have more profound and consistent detrimental effects on performance as compared to effects elicited by somatic anxiety. Burton (1988) provided some empirical field support for that "anxiety/performance" hypothesis. More specifically, when studying multidimensional aspects of anxiety and swimming performance, his data supported the following: (a) Somatic anxiety was aligned with an inverted-U function; (b) self-confidence exhibited a positive linear relationship; and (c) cognitive anxiety represented a negative linear relationship.

In summary, based on current thinking and some extant evidence, the reasoning underlying the study was that if the mental errors that occur during competition are representative of cognitive/attentional disruptions, then, both theoretically and intuitively, individuals who exhibit more mental errors should have higher cognitive anxiety than those who demonstrate fewer mental errors.

Method

Subjects

The initial subject pool consisted of 202 female high school varsity softball players who ranged in age from 14 to 17 years. Players were associated with three leagues (two Division 4A leagues and one Division 3A league). Informed consent was obtained from all subjects subsequent to receiving permission from the appropriate school officials and head softball coaches.

Assessment Instruments

CSAI-2. The Competitive State Anxiety Inventory-2 (CSAI-2) (Martens et al., 1983) was used to assess differing levels of competitive state anxiety. Due to the multidimensionality of the inventory, both cognitive and somatic anxiety as well as precompetitive levels of self-confidence were assessed. Based on the data obtained by its developers, the CSAI-2 appears to have acceptable internal reliability (0.79 to 0.90) and sufficient construct validity.

Operationalization of Mental Errors. A scale, Mental Error Questionnaire, was developed by the experimenters to allow coaches to quantify the relative amount of mental errors committed by each player. Coaches were told that mental errors could be defined as the degree to which each player's performance was adversely affected during a particular game as compared with her usual performance during practice. It was a 10-point bipolar scale ranging from very much affected (many mental errors) to very little affected (few mental errors). Using the coach's ratings of each player's relative amount of mental errors, final subject selection was based on the identification of those individuals who scored at the extremes of the scale. Through this process emerged two groups of subjects: higher in mental errors and lower in mental errors.

Procedures

Arrangements for data collection were made on an individual basis with each school's head varsity softball coach. Administration of the CSAI-2 was completed from 1 hour to 45 minutes prior to a scheduled game at the site of the competition. The experimenter read standardized instructions. Immediately following the game, the head coach completed the Mental Error Questionnaire for each player.

Final subject selection ($N=161$) was based on the individual athlete's mental error score as determined by the Mental Error Questionnaire. Subjects ($n=118$) who scored between 1 and 4 on the scale were classified as being lower in mental errors while subjects ($n=43$) who scored between 7 and 10 were categorized as being higher in mental errors.

Results

Multivariate analysis of variance (MANOVA) (adapted for unequal cells) was used to determine if there were any overall differences between the low and high mental error groups. Dependent variables were cognitive anxiety, somatic anxiety, and self-confidence. The effect for overall multivariate group differences was significant, $F(3,157)=2.84$, $p<.04$. Subsequent analysis of variance yielded a single significant univariate main effect in that the two mental error groups differed in cognitive anxiety, $F(1,159)=7.16$, $p<.01$. The mean of the lower mental error group ($M=19.72$) differed significantly from the mean of the higher mental error group ($M=22.35$). Neither the univariate main effect for somatic anxiety, $F(1,159)=.17$, $p=.68$, nor the univariate main effect for self-confidence, $F(1,159)=.33$, $p=.56$, was significant.

Discussion

The results of this investigation support the prediction that elevations in cognitive anxiety are directly related, in a linear fashion, to mental errors that occur during sport performance. Thus the findings are in agreement with the theoretically based predictions about the relationship between cognitive anxiety and attentional disruptions. However, they do not support the positive linear relationship previously proposed between self-confidence and sport performance (e.g., Burton, 1988). In fact, the obtained means for both the lower and higher mental error groups were identical ($M=35$).

Consistent with other available evidence, the predictive ability of the CSAI-cog and CSAI-sc scales may vary as a function of certain situational factors, skill level, or nature of the sport (e.g., Burton, 1988; Martens et al., 1983). This appears to be a fertile ground for further research. On the other hand, given the strength of the effect for the CSAI-cog shown in a field setting, future studies might allow for more insight into the cognitive anxiety/sport performance relationship by identifying variables that are most integral to the attentional/cognitive disruption process rather than focusing solely on objective sport outcome. Particularly in sports in which the environment or other extraneous factors can vary to affect outcome, the measurement of objective performance outcome alone may not be sensitive enough to accurately reflect individual variations in cognitive parameters or processes, whether that process be cognitive anxiety or self-confidence.

As a side effect, it was interesting to note that the cell sizes obtained in a naturally occurring field setting were quite unequal, with many more softball players demonstrating lower mental errors ($n=118$) as opposed to higher mental errors ($n=43$). One explanation could be the coach's inherent bias in rating the athletes. However, the magnitude of the statistical effect would argue for their validity.

The rationale underlying the development of the CSAI-2 was based on current research and theory which argues that anxiety should be conceptualized as including at least its two separate dimensions: cognitive (worry) and somatic (heightened physiological activation). Within that framework, any differences evidenced in number of mental errors committed should be most closely associated with cognitive rather than somatic anxiety. The results clearly support that association and therefore demonstrate evidence for the independence of the two anxiety constructs. Therefore, the current findings also fit within the bidimensional model of anxiety proposed by psychologists (e.g., Liebert & Morris, 1967; Schwartz et al., 1978) and sport psychologists (e.g., Bird & Cripe, 1986; Gould et al., 1987; Martens et al., 1983).

In addition, the results provide some further evidence relative to the construct validity of the CSAI-2. More specifically, if mental errors are a true reflection of attentional/cognitive dysfunctions, and if such dysfunctions are indeed associated with elevations in cognitive anxiety, then differential scores on CSAI-cog should reflect those differences. This reasoning received empirical support in the current investigation and therefore demonstrated some construct validity for the assessment instrument.

On a more practical level, much of the work in the field of sport psychology is being directed toward aspects of anxiety testing and performance interventions. At this point it is critical that we begin to understand more about exactly how elevated anxiety affects sport performance. There is no argument that effects do occur, but now we need to know more about the intricacies of the anxiety process and effects on motor output.

This investigation has provided some insight into one aspect of the anxiety process and the resultant effects on individual sport performance. In terms of translating the findings into applications, then, when selecting appropriate intervention techniques, cognitively based strategies should provide the most effective avenues for reducing mental errors in sport. Meichenbaum's (1977) stress inoculation framework is one cognitively based framework that has been adapted for use with athletes (Long, 1980), while Bandura's (1977) self-efficacy theory has also shown some promise (Harrison & Feltz, 1981).

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