CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Anxiety Performance Theories

2.2 Multidimensional Conceptualisation of Anxiety

2.3 Processing Efficiency Theory

2.4 Catastrophe Model

2.5 Interpretation of Anxiety

2.6 Studies Related to Directional Interpretation of Anxiety-Performance Relationship.

2.7 The Mental Health Model

2.8 The Conceptual Model

2.9 Applied Anxiety Management in Sport

2.10 Progressive Muscular Relaxation

2.11 Autogenic Training

2.12 Studies Related to Breathing Technique (Pranayama)

2.13 Imagery
CHAPTER TWO

REVIEW OF RELATED LITERATURE

Review of related literature formed the basis and direction for the present study. A thorough review on athletic performance revealed that conception of anxiety although generally considered the major cause for impairing performance had changed considerably. The influence of pre competitive mood states on athletic performance was also found to be an emerging concept. This provided impetus to explore anxiety-mood performance relationship prior to employing interventions and evaluating their effects in enhancing athletic performance. Sports psychology literature revealed that an individual responding with anxiety to competing in sports need not necessarily respond similarly to a different situation (Burton, 1998). The impact of trait anxiety may be based on different dimensions of social evaluation, physical danger or any other situations in daily life (Endler and Kocovski 2001). Sports psychology literature identified necessity for the use of sports specific trait and state anxiety measures of anxiety. Accordingly Sport Competition Anxiety Test (SCAT) (Martens 1977; Martens et al., 1990) and modified Competitive State Anxiety Inventory (CSAI) (Martens et al., 1990) were adopted to measure trait anxiety and state anxiety of the participants of the study. Similarly the adoption of “Brunel Mood Scale” (BRUMS; Terry et al., 1999) in the present study to measure pre competitive mood states emerged from an in depth study on the earlier researches on mood states and athletic performance.
2.1 Anxiety Performance Theories

Refinement in conceptualization of anxiety was the result of a plethora of theories, progress, and understanding into human behaviour in sport. Drive theory (Hull, 1943; Spence and Spence 1966), Inverted-U Hypothesis (Yerkes and Dodson 1908) were the premier theories examining the relationship of arousal to performance in which anxiety were considered to be present at high levels of arousal (Weinberg, 1989). The premier theories used unidimensional approaches to explain the arousal performance relationship. Drive theory proposes a linear relationship between arousal and performance, whereas the Inverted-U hypothesis proposes a quadratic curve to make this relationship explicit. Emergence of multidimensional concept of anxiety led to the rejection of unidimensional theories of anxiety on account of its inability to assimilate ongoing developments in the measurement and management of anxiety in sport (Marchant and Morris 2004).

2.2 Multidimensional Conceptualisation of Anxiety

General theories of emotion defined anxiety in terms of cognitive, physiological, and behavioural components even when anxiety was considered a unidimensional construct (Ellis, 1994). Educational psychologists Liebert and Morris (1967) were the first to identify somatic and cognitive sub-components of state anxiety. They developed the Worry-Emotionality Inventory (WEI; Liebert and Morris 1967) in connection with the two component model of test anxiety that was based on the concepts of worry and emotionality. Clinical psychologists Davidson and Schwartz (1976) working on similar lines found that they could effectively negate either form of anxiety through selective relaxation therapy, i.e.,
focusing on one, or both, of the factors. Concurrently, Schwartz, et al., (1978) developed the Cognitive Somatic Anxiety Questionnaire (CSAQ), which is a multidimensional trait scale. In concurrence with the multidimensional nature of anxiety, Morris, Davis and Hutchings (1981) defined cognitive anxiety as “the cognitive elements of the anxiety, such as negative expectations and cognitive concerns about oneself, the situation at hand and potential consequences”. Somatic anxiety was defined as “one’s perception of the physiological-affective elements of the anxiety experience, that is, indications of autonomic arousal and unpleasant feeling states such as nervousness and tension”.

The complete assimilation of the concept of a multidimensional theory of anxiety into the field of sport psychology was brought about by Martens, et al., (1990) development of the Competitive State Anxiety Inventory-2 (CSAI-2). The CSAI-2 is a sport specific, multidimensional, state anxiety questionnaire that measures the intensity of cognitive and somatic anxiety. The construct self-confidence has also been included along with cognitive and somatic subscales in CSAI-2. Anxiety and self confidence were viewed as reflecting opposite ends of the same continuum in earlier literature. Self-confidence has been described as a phenomenon resulting from a lack of anxiety by Borkovec (1978). Similarly Bandura (1977a) suggested anxiety to result from a lack of self confidence, or self-efficacy. However, Martens and co-workers' (1990a) factor analysis of CSAI-2 revealed orthogonal anxiety and self-confidence factors. Accordingly they were considered to be relatively independent of each other, rather than at opposite ends of the same continuum.
Martens et al., (1990) defined competitive trait anxiety as “a tendency to perceive competitive situations as threatening and to respond to these situations with competitive state anxiety. Competitive state anxiety was defined as “an existing or current emotional state in competitive situations characterized by feelings of apprehension and tension and associated with activation of the organism”. Researches in psychology have reinforced the need for employing anxiety measures that are sensitive to the unique characteristics of different situations (Watson and Friend 1969). Martens et al., (1990) proposed that state anxiety is comprised of cognitive anxiety (cognitive-worry) and somatic anxiety (emotional-arousal). Cognitive anxiety “is the mental component of anxiety and is caused by negative expectations about success or by negative self-evaluations” and somatic anxiety “refers to the physiological and effective elements of the anxiety experience that develop directly from autonomic arousal” (Martens et al., 1990,). Martens et al., (1990) proposed that somatic anxiety had an Inverted-U shaped relationship with performance, whereas cognitive anxiety had a negative linear relationship with performance. The theories of attention (Wine, 1971, 1980), formed the basis for the hypothesized negative linear relationship between cognitive anxiety and performance. Pre occupation with negative concerns personal worries was considered to cause the inability to attend to the necessary task to be performed. Martens and co-workers’ (1990a) factor analysis of CSAI-2 revealed orthogonal anxiety and self-confidence factors, which suggests that they should be regarded as being relatively independent of each other, rather than at opposite ends of the same continuum.
A theoretical explanation for the hypothesized curvilinear relationship between the perception of one’s physiological arousal (i.e. somatic anxiety) and performance has not been provided (Woodman and Hardy 2001a). Physiological symptoms were not thought to have much influence on performance unless the athlete became too pre occupied with the symptoms. It was also predicted to increase up to the start of the competition and there after decrease significantly which would decrease its significance on performance (Martens et al., 1990a). Studies testing multidimensional anxiety theory are given below.

2.2.1 Studies Conducted on Multidimensional Anxiety Theory

Burton (1988) conducted a study testing the multidimensional measure of anxiety proposed by (Martens et al., 1990). Two samples of swimmers completed the CSAI-2 prior to competition, and performance data were obtained from meet results. Correlation and multiple regression analyses supported that cognitive anxiety is more consistently and strongly related to performance than is somatic anxiety and that short duration and high and low complexity events demonstrate stronger relationships between somatic anxiety and performance than do long duration or moderate complexity events. Polynomial trend analyses on standardized CSAI-2 scores confirmed that Somatic anxiety demonstrates an inverted-U relationship with performance, whereas self-confidence and performance exhibit a positive linear relationship and cognitive anxiety and performance exhibit a negative one. Overall, these results not only revealed that improved instrumentation allows demonstration of consistent anxiety-performance relationships, but they also provided additional construct validity for the CSAI-2.
Chapman *et al.*, (1997) conducted a study on hundred and forty two male Tae Kwon-do competitors examining the effect of competitive anxiety on performance. Pre competitive anxiety was measured using Competitive State Anxiety Inventory-2 about one hour before competition. Multivariate analysis of variance showed that the players who won reported lower cognitive and somatic anxiety and higher self-confidence than those who lost. Discriminant function analysis indicated that eighty nine (62.68 %) participants could be correctly classified as winners or losers on the basis of pre competition Competitive State Anxiety Inventory-2 scores. Findings concurred with theoretical proposals to the extent that reported self-confidence was facilitative and cognitive anxiety was debilitative of performance. However, the finding that winners reported significantly lower scores for somatic anxiety than losers challenges the notion that somatic anxiety has a curvilinear relationship with performance *(Martens *et al.*, 1990) not supporting the theoretical model for somatic anxiety. Chapman *et al.*, (1997) thus found only partial support for Martens *et al.*, 1990) multidimensional theory.

Gould *et al.*, (1984) conducted two studies to examine antecedents of relationships between and temporal changes in the cognitive anxiety, somatic anxiety, and the self-confidence components of the Martens, *et al.*, (1990) Competitive State Anxiety Inventory-2 (CSAI-2). In addition, the prediction that cognitive and somatic anxiety should differentially influence performance was examined. In Study 1, thirty seven elite intercollegiate wrestlers were administered the CSAI-2 immediately before two different competitions, whereas in Study 2,
sixty three female high school volleyball players completed the CSAI-2 on five different occasions (1 week, 48 hours, 24 hours, 2 hours, and 20 minutes) prior to a major tournament. The results were analyzed using multiple regression, multivariate multiple regression, univariate and multivariate analyses of variance, and general linear model trend analysis techniques.

The findings supported the scale development work of Martens and his colleagues by verifying that the CSAI-2 assesses three separate components of state anxiety. A number of other important findings also emerged. First, the prediction was confirmed that somatic anxiety increases during the time leading to competition, while cognitive anxiety and confidence remain constant. Second, CSAI-2 subscales were found to have different antecedents, although the precise predictions of Martens and his colleagues were not supported. Third, the prediction that cognitive anxiety would be a more powerful predictor of performance than somatic anxiety was only partially supported. Fourth, the prediction that pre competitive anxiety differed between experienced and inexperienced athletes initially found by Fenz (1975) result from somatic anxiety changes was not supported. It was concluded that the CSAI-2 shows much promise as a multidimensional sport-specific state anxiety inventory, although more research is needed to determine how and why specific antecedent factors influence various CSAI-2 components and to examine the predicted relationships between CSAI-2 components and performance.

Gould et al., (1987) examined whether linear or curvilinear (inverted-U) relationships exist between Competitive State Anxiety Inventory-2 subscale scores
and pistol shooting performance in a paradigm that addressed previous design, methodological, and data analysis problems. Officers ($N = 39$) from the University of Illinois Police Training Institute served as subjects and participated in a pistol shooting competition. Each subject shot on five separate occasions, immediately after completing the CSAI-2 (Martens, et al., 1990), a multidimensional measure of state anxiety. It was predicted that cognitive state anxiety would be more related to performance than would somatic state anxiety. However, relationships between both types of anxiety and performance were predicted to support inverted-U as opposed to linear relationships. Self-confidence was predicted to be positively related to performance.

Results were analyzed using the intra individual analysis procedures recommended by Sonstroem and Bernardo (1982) and showed that cognitive anxiety was not related to performance, somatic anxiety was related to performance in a curvilinear (inverted-U) fashion, and confidence was negatively related to performance.

Karteroliotis and Gill (1987) examined the relationships of cognitive worry, somatic anxiety, and self-confidence (components of the Competitive State Anxiety Inventory-2) to each other, physiological measures, and motor performance prior to, during, and after competition. Forty one undergraduate males competed against a confederate in a motor task while heart rate and blood pressure responses were monitored. Results confirm the multidimensional nature of the state anxiety construct and provide evidence for the independence of cognitive worry and somatic anxiety. Both dimensions followed similar temporal patterns prior to
and during competition. Results support the non significant relationship between psychological and physiological measures of anxiety.

Krane and Williams (1987) compared changes in cognitive anxiety, somatic anxiety, and self-confidence prior to competition by high school gymnasts and collegiate golfers. A version of the Competitive State Anxiety Inventory (CSAI-2) was administered twenty four hours, one hour, and ten minutes prior to competition. Results of ANOVAs showed the golfers and gymnasts to have different patterns of change in the CSAI-2 subcomponents. The gymnasts displayed an increase in cognitive and somatic anxiety and a decrease in self-confidence while the golfers showed a decrease in cognitive anxiety, an increase in self-confidence and no change in somatic anxiety. Overall, the golfers had lower cognitive and somatic anxiety and higher self-confidence than the gymnasts. Multiple regression analyses indicated none of the CSAI-2 subcomponents was able to significantly predict high school gymnastic and collegiate golf performance.

Craft et al., (2003) conducting a meta-analysis reported that findings have been inconsistent, with some research suggesting that cognitive anxiety, somatic anxiety and self confidence have separate relationships with performance and other studies failing to find any relationship between the anxiety subcomponents and performance. He included twenty nine studies conducted till 1999 evaluating competitive anxiety performance relationship using CSAI-2, examining the effect of state anxiety as measured by the CSAI-2 (i.e., cognitive anxiety, somatic anxiety, and self-confidence) on athletic performance. Studies were coded for
characteristics that could potentially moderate the effects of anxiety on performance (i.e., features of design, subjects, and sport). Interdependency between the three subscales was examined using multivariate meta-analytic techniques (Becker and Schram 1994). Relationships among cognitive anxiety, somatic anxiety, self-confidence, and performance appeared weak. Exploratory modelling showed that self-confidence displayed the strongest and most consistent relationship with performance.

To summarize, multidimensional anxiety theory has not been successful in explaining the relationship between anxiety and performance and their relationship is much more complex than explained in the theory (LeUnes and Nation 2002). A number of researchers have negated the independent relationship of cognitive and somatic anxiety as suggested in the multidimensional theory (Petlichkoff and Gould 1985). Although the validity of multidimensional anxiety theory has been questioned the CSAI-2, cognitive and somatic anxiety continue to be studied as separate identities as it is considered useful in comprehending the different effects they have on sports performance (Gould et al., 2002).

The adoption of a multidimensional approach in anxiety-performance research has been an encouraging and an important step in the right direction in the pragmatic assessment of anxiety-performance relationship in sport psychology (Parfitt et al., 1990). It has been instrumental in re conceptualizing anxiety. Researchers now accept that anxiety can be functionally facilitative or debilitating to an individual’s performance depending upon an individual’s cognitive appraisal (Jones and Hanton 2001).
2.3 Processing Efficiency Theory (Eysenck and Calvo 1992)

The main prediction of processing efficiency theory is that worry utilizes some of the processing and storage resources of a limited capacity working memory system (Baddeley, 1986). Therefore the negative effects of worry on task performance should be greater on tasks that exert large demands on the capacity of the working memory system.

The processing efficiency theory also predicts that worry or cognitive anxiety can serve a motivational function. As the anxious performer may attempt to increase effort and thereby activate additional processing resources if he/she feels that performance is, or may be, substandard. If successful, such increases in effort increase the available working memory and, consequently, may enhance performance (Eysenck and Calvo 1992). However, according to earlier versions of the theory, (Eysenck, 1982) increased effort will only occur when performers perceive themselves to have at least a moderate subjective probability of success; that is to say, when they are at least moderately confident. Thus, according to processing efficiency theory, anxiety typically impairs processing efficiency (task performance divided by effort) more than it impairs task performance - hence the theory’s name. The predictions of processing efficiency theory have received empirical support from a number of studies (Calvo, et al., (1994); Derakshan and Eysenck, (1998); Kellogg, et al., (1999); and Smith, et al., (2001).
2.3.1 Studies Conducted on Processing Efficiency Theory

Calvo et al., (1994) evaluated the effects of test anxiety and evaluative stress on reading speed, articulatory rehearsal, reading regressions, and comprehension. High and low test anxiety subjects read texts under conditions of stress or non-stress. Texts were presented either with concurrent irrelevant speech (heard), an articulatory suppression task, or no concurrent task. Measures of working memory span and prior vocabulary knowledge were collected under non-stress conditions. There were no differences in comprehension performance as a function of anxiety, but high anxious subjects were less efficient than low-anxious subjects, as the former employed more reading time and regressions, though not more articulation, than the latter to obtain an equivalent comprehension score.

Derakhshan and Eysenck (1998) evaluated the verbal reasoning performance of high-anxious (high trait anxiety, low defensiveness), defensive high-anxious (high trait anxiety, high defensiveness), repressor (low trait anxiety, high defensiveness), and low-anxious (low trait anxiety, low defensiveness) groups was examined under high and low memory load conditions. As predicted by the processing efficiency theory (Eysenck and Calvo 1992), the slowing of reasoning speed with the high memory load was disproportionately great for the high-anxious and defensive high-anxious groups. The effects of high memory load on reasoning speed were the same for the low-anxious and repressor groups, suggesting that both groups had equivalently low levels of worrying (and other anxiety related) task-irrelevant thoughts.
Kellogg et al., (1999) conducted a study on highly math-anxious individuals to test if they were less proficient on arithmetic tasks, particularly those that involve complex problems. The processing efficiency theory postulates that in highly anxious individuals, working memory resources are consumed by “worry,” thereby leaving fewer resources available for task completion. Although there is some empirical support for this theory, the precise nature of this worry has yet to be identified. The researchers tested the hypothesis that time pressure may be one component contributing to worry, and subsequent performance deficits characteristic of high math-anxious individuals. Thirty participants completed arithmetic problems of varying complexity in both a timed and untimed condition. Although the timing manipulation negatively affected arithmetic performance in both high and low anxious participants, anxiety groups were not differentially affected. Researchers may therefore have to look to other variables to explain the nature of worrisome thoughts that are theorized to disrupt the performance of anxious individuals.

Parfitt and Pates (1999) evaluated the influence of competitive anxiety and self-confidence state responses upon components of performance. Basketball players (n = 12) were trained to self-report their cognitive anxiety, somatic anxiety and self-confidence as a single response on several occasions immediately before going on court to play. Performance was video-recorded and aspects of performance that could be characterized as requiring either largely anaerobic power (height jumped) or working memory (successful passes and assists) were measured. Intra-individual performance scores were computed from these
measures and the data from seven matches were subjected to regression analyses and then hierarchical regression analyses.

The results indicated that, as anticipated, somatic anxiety positively predicted performance that involved anaerobic demands. Self-confidence, and not cognitive anxiety, was the main predictor of performance scores with working memory demands. It would appear that different competitive state responses exert differential effects upon aspects of actual performance. The result has been quoted by Parfit and Pates (1999) as another example of cognitive anxiety leading to an increase in effort on the task and the appropriate allocation of attentional resources serving to improve performance proposed by Eysenck, (1982).

Smith et al., (2001) tested some key postulates of Eysenck and Calvo's (1992) processing efficiency theory in a team sport. The participants were twelve elite male volleyball players who were followed throughout the course of a competitive season. Self-report measures of pre-match and in-game cognitive anxiety and mental effort were collected in groups of players high and low in dispositional anxiety. Player performance was determined from the statistical analysis of match-play. Sets were classified according to the point spread separating the two teams into one of three levels of criticality. Game momentum was also analysed to determine its influence on in-game state anxiety. Significant differences in in-game cognitive anxiety were apparent between high and low trait anxiety groups. An interaction between anxiety grouping and momentum condition was also evident in cognitive anxiety. Differences in set criticality were reflected in
significant elevations in mental effort, an effect more pronounced in dispositionally high anxious performers. Consistent with the predictions of processing efficiency theory, mental effort ratings were higher in high trait-anxious players in settings where their performance was equivalent to that of low trait-anxious performers. The usefulness of processing efficiency theory as an explanatory framework in sport anxiety research is discussed in the light of these findings.

Wilson et al., (2007) tested the conflicting predictions of processing efficiency theory (PET) and the conscious processing hypothesis (CPH) regarding effort’s role in influencing the effects of anxiety on a golf putting task. Mid-handicap golfers made a series of putts to target holes under two counterbalanced conditions designed to manipulate the level of anxiety experienced. The effort exerted on each putting task was assessed through self-report, psycho-physiological (heart rate variability) and behavioural (pre-putt time and glances at the target) measures. Performance was assessed by putting error. Results were generally more supportive of the predictions of PET rather than the CPH as performance was maintained for some performers despite increased state anxiety and a reduction in processing efficiency. The findings of this study support previous research suggesting that both theories offer useful theoretical frameworks for examining the relationship between anxiety and performance in sport.

To summarize processing efficiency theory (Eysenck and Calvo, 1992) has been successful in explaining to an extent why cognitive anxiety is detrimental to performance some time while it proves favourable to performance at other times. The main prediction of processing efficiency theory is that worry utilizes some of
the processing and storage resources of a limited capacity working memory system (Baddeley, 1986). Therefore the negative effects of worry on task performance should be greater on tasks that exert large demands on the capacity of the working memory system. The processing efficiency theory also predicts that worry or cognitive anxiety can serve a motivational function. As the anxious performer may attempt to increase effort and thereby activate additional processing resources if he/she feels that performance is, or may be, substandard. If successful, such increases in effort increase the available working memory and, consequently, may enhance performance (Eysenck and Calvo 1992). However, according to earlier versions of the theory, (Eysenck, 1982) increased effort will only occur when performers perceive themselves to have at least a moderate subjective probability of success; that is to say, when they are at least moderately confident. Thus, according to processing efficiency theory, anxiety typically impairs processing efficiency (task performance divided by effort) more than it impairs task performance.

Even when anxiety was generally viewed as negative and thought to have a harmful impact on performance, (Jones, 1995) different interpretations of anxiety symptoms (positive and negative) have been considered in the test anxiety literature since the early 1960’s. Alpert and Haber (1960) developed the Achievement Anxiety Test (AAT) scale that measured both debilitating and facilitative interpretations of anxiety, as he felt it was a more sensitive predictor of academic performance than a conventional scale based on a “debilitating only” conceptualisation of anxiety. A number of other researchers in general psychology
had recognized the value of distinguishing between debilitative and facilitative interpretations of symptoms associated with anxiety in the academic/educational setting (Carrier, et al., 1984).

2.4 Catastrophe Model

Hardy’s (1990) cusp catastrophe model of anxiety and performance was developed following the original work of Zeeman (1976), with the attempt of explaining the inconsistent findings regarding the effects of anxiety upon performance (Parfitt, et al., 1990). The model is based on the view that performance anxiety is a multidimensional construct combining a cognitive component, ‘negative expectations and cognitive concerns about oneself, the situation at hand and potential consequences’ (Morris, et al., 1981), and a physiological arousal component, defined in this context as ‘the organism’s natural physiological response to anxiety-inducing situations’ (Hardy, 1990,). The cusp catastrophe model uses this multidimensional conceptualization to predict interactive effects for cognitive anxiety (worry) and physiological arousal upon performance in a three-dimensional model (Figure 1).

The model proposes that a series of four relationships exists between cognitive anxiety, physiological arousal and performance (Hardy, 1990, 1996a). First, it is proposed that cognitive anxiety (worry) has a positive relationship with performance when physiological arousal is low (left face of the model). Second, cognitive anxiety will have a negative relationship with performance when physiological arousal is high (right face of the model). Third, when cognitive anxiety is low, physiological arousal has an inverted U-shaped relationship with
performance (see the back face of the model). Finally, when cognitive anxiety is high, increased levels of physiological arousal lead to a catastrophic drop in performance from the upper performance surface (A) to the lower performance surface (B), as indicated by the front face of the model. Furthermore, once this catastrophic drop in performance has occurred, a large reduction in physiological arousal is required to bring performance back on to the upper performance surface.

Fig. 2.1 Catastrophe Model demonstrating the association between anxiety and performance (Fazey and Hardy, 1988)

2.4.1 Studies Related to Catastrophe Model

Hardy and Parfitt (1991) tested Fazey and Hardy’s (1988) catastrophe of anxiety and performance on eight experienced basket ball players. Their performance of a set of shooting task was evaluated at high and low levels of cognitive anxiety and increasing and decreasing physiological arousal. Physiological arousal was manipulated by physical work. Curve–fitting procedures followed by non parametric tests of significance confirmed Fazey and Hardy’s hysteresis hypothesis that the polynomial curves for the increasing Vs decreasing
arousal conditions would be horizontally displaced relative to each other in the high cognitive condition, but superimposed on top of one other in the low cognitive anxiety. Further the subject’s maximum performance was higher and minimum performance lower and their critical decrements in performance greater in the high cognitive anxiety condition than in low cognitive anxiety condition. This proved strong support for Fazey and Hardy's (1988) catastrophe model of anxiety and performance.

Hardy et al., (1994) conducted an experiment to test Fazey and Hardy's (1988) catastrophe model of anxiety and performance. Eight experienced crown green bowlers performed a bowling task under conditions of high and low cognitive anxiety. On each of these occasions, physiological arousal (measured by heart rate) was manipulated by means of physical work in such a way that the subjects were tested with physiological arousal increasing and decreasing. A repeated-measures three-factor ANOVA was used to test the hysteresis hypothesis that the performance - heart rate graph would follow a different path for heart rate increasing compared with heart rate decreasing in the high cognitive anxiety condition, but not in the low cognitive anxiety condition. The ANOVA revealed the predicted three-way interaction of cognitive anxiety, heart rate, and the direction of change in heart rate upon performance, with follow-up tests indicating that the interaction was due to hysteresis occurring in the high cognitive anxiety condition but not in the low cognitive anxiety condition. Other statistical procedures showed that, in the high cognitive anxiety condition, subject’s best performances were significantly better, and their worst performances significantly
worse, than in the low cognitive anxiety condition. The results did not provide unequivocal support for the catastrophe model of anxiety and performance.

Hardy (1996a) tested the catastrophe and multidimensional anxiety theory based behavior surfaces of data obtained from eight experienced golfers. The subjects were first taught to self-report their cognitive anxiety, somatic anxiety and self-confidence levels as a single integer on a scale from 1 (low) to 27 (high). These single integer scales were then used to monitor levels of cognitive anxiety, somatic anxiety, and self-confidence, together with physiological arousal (operationalized as heart rate), prior to each putt during a Stapleford golf competition. All data was standardized within subjects in order to control for individual differences in response sensitivity and putting ability. Preliminary examination of the results suggested that the catastrophe models were superior to the multidimensional anxiety theory models, and that the inclusion of self-confidence significantly improved the goodness of fit of both models. However, further tests of other control models suggested that the apparent superiority of the catastrophe models was probably due to the inclusion of a temporal factor in Guastello's method of dynamic differences.

This study did find interactive effects for cognitive anxiety and physiological arousal upon performance. On both of these occasions, significant three factor interactions between cognitive anxiety, physiological arousal, and the direction of change of physiological arousal upon performance have confirmed the hypothesis.
Edwards and Hardy, (1996) examined intensity and direction of competitive state anxiety symptoms, and the interactive influence of anxiety subcomponents upon netball performance. Netball players (N = 45) completed the modified Competitive State Anxiety Inventory-2 (CSAI-2) and a retrospective performance measure over a season, utilizing an intra individual design. The modified CSAI-2 includes a direction scale assessing the facilitative or debilitative interpretation of the original intensity symptoms. Although the facilitative influence of anxiety upon performance did not emerge directly through the direction scale, a significant interaction emerged from the two-factor Cognitive Anxiety-Physiological Arousal quadrant analyses, suggesting that anxiety may enhance performance, as proposed by catastrophe model predictions. Findings also highlighted the importance of self-confidence for possible inclusion in higher order catastrophe models.

Hardy et al., (2007) conducted two studies testing the cusp catastrophe model of anxiety and performance, and the hysteresis effect in particular. Task difficulty was used to manipulate effort required in a letter transformation task. Experiment 1 (N = 32) used high levels of trait anxiety together with a competitive environment to induce state anxiety. Experiment 2 (N = 20) used a competitive environment with social pressure and ego threat instructions to induce high levels of worry. Both studies revealed significant three-way interactions as hypothesized with follow-up tests showing some support for the hysteresis hypothesis in Study one, and strong support for the hysteresis hypothesis in Study two.
The findings support a processing efficiency theory explanation of anxiety-induced performance catastrophes and indicate that two cusp catastrophe models of performance may exist; one that incorporates the interactive effects of cognitive anxiety and physiological arousal upon performance and the other that incorporates the interactive effects of cognitive anxiety and effort required upon performance.

To summarize researchers have found support for the interactive effects between cognitive anxiety and somatic anxiety/physiological arousal for cusp catastrophe model. The details of the interaction however have not always been completely consistent with the cusp catastrophe model. The model has generated a holistic approach and encouraged researchers to think beyond simplistic conceptualizations of complex relationships (Woodman and Hardy 2007). The underlying mechanisms mediating the relationships between anxiety intensity, direction, and performance continue to be in the developmental stages. Further research in these areas is indispensable for effective management of anxiety in sport.

2.5 Interpretaion of Anxiety

Even when anxiety was generally viewed as negative and thought to have a harmful impact on performance (Jones, 1995), different interpretations of anxiety symptoms (positive and negative) have been considered in the test anxiety literature since the early 1960’s. Alpert and Haber (1960) developed the Achievement Anxiety Test (AAT) scale that measured both debilitative and facilitative interpretations of anxiety, as he felt it was a more sensitive predictor of
academic performance than a conventional scale based on a “debilitative only” conceptualisation of anxiety. A number of other researchers in general psychology had recognized the value of distinguishing between debilitative and facilitative interpretations of symptoms associated with anxiety in the academic/educational setting (Carrier, et al., 1984).

Direction of anxiety interpretation was introduced in sport psychology fifteen years after its emergence in general psychology (Jones, 1991). It has now become the standard practice in measuring anxiety in sport settings (Wang, Morris, and Marchant 2004). The interpretations are a measure of competitors perception of their anxiety intensity symptoms, on a continuum from highly facilitative through neutral (i.e., that the interpretation of anxiety intensity was deemed unimportant to upcoming performance), to highly debilitative, in relation to their ensuing performance (Jones and Hanton 2001).

Direction of anxiety is the cognitive appraisal of interpreting the perceived cognitive and physiological symptoms experienced in relation to the competitor’s goals (Jones, 1995). The interpretation of anxiety was measured using a modified version of the CSAI-2. The directional scales have been added to the standard measures of the perceived intensity of anxiety symptoms. The incorporation of directional scale into CSAI-2 is not without criticism as makes it longer to complete the questionnaire, where brevity is the necessity on account of the measures to be completed so close to the start of the competition. The significant impact on responses on longer questionnaires and the viability of using this measure in the applied setting has raised arguments (Edwards and Hardy 1996).
CSAI-2 has also received a lot of criticism on account of consisting words like “I am concerned about this competition” which might be interpreted as a negative state that is debilitating to performance whereas it might be perceived as a positive affective mental state that facilitates performance by others. Hence the athlete with a positive perception may be wrongly judged as high on cognitive or somatic anxiety scoring (Burton and Naylor 1997).

2.5.1 Studies Related to Interpretation of Anxiety

Mahoney and Avener (1977) conducted a study on thirteen male gymnasts who were given a standard questionnaire and interviewed during the final trials for the U.S. Olympic team. Particular attention was given to psychological factors and cognitive strategies in their training and competition. Using their final competitive grouping as the primary dependent variable, correlations were performed to assess the relationship between these factors and superior athletic performance. Data from this exploratory study suggested that varying patterns of cognition may be strongly correlated with successful and superior gymnastic performance. Specifically, dream frequency, self-verbalizations, and certain forms of mental imagery seemed to differentiate the best gymnasts from those who failed to make the Olympic team. These two groups also appeared to show different anxiety patterns and different methods of coping with competitive stress. Gymnasts selected to the Olympic team had a pre-existing tendency to interpret their anxiety symptoms as performance enhancing, whereas those gymnasts who were unsuccessful had a tendency to interpret their anxiety symptoms as performance blocking.
Jones and Swain (1992) examined differences in intensity and direction of symptoms of competitive state anxiety in high and low competitive subjects from team sports that included rugby union, basketball, soccer, and field hockey. The sixty-nine men were dichotomized via a median-split into high and low competitive groups based on their scores on the Sport Orientation Questionnaire. All subjects completed a modified version of the Competitive State Anxiety Inventory-2 thirty minutes prior to competition. Direction scale was included along with the intensity scale on which subjects rated the experienced intensity of each symptom as facilitative or debilitative to subsequent performance. There were no significant group differences on intensity of cognitive anxiety or of somatic anxiety or on direction of somatic anxiety; however, the highly competitive group of thirty-four subjects reported their anxiety as more facilitative and less debilitative than the low competitive group (n = 35).

The study supports the proposal that sports performer’s directional perceptions of their anxiety symptoms may provide further understanding of the competitive state-anxiety response.

Jones et al., (1993) examined relationships between intensity and direction dimensions of competitive state anxiety. Forty-eight gymnasts, whose ages ranged from fourteen to sixteen years, were divided, via the median split technique, into poor performance and good performance groups. All the subjects completed a modified version of the Competitive State Anxiety Inventory-2 (CSAI-2) ten minutes prior to performance. This inventory included the original intensity scale plus a direction scale in which subjects rated the degree to which the experienced
intensity of each symptom was either facilitative or debilitative to subsequent beam performance. Analyses of variance showed no significant group differences on any of the CSAI-2 sub-component intensity scores, or on somatic anxiety and self-confidence direction scores. However, the good performance group reported their cognitive anxiety intensity as being more facilitating and less debilitating to performance than the poor performance group. Stepwise multiple-regression analyses showed that the only significant predictor of beam performance was self-confidence intensity. These findings support the proposal that sports performer’s directional perceptions of their anxiety symptoms may provide further understanding of the competitive state anxiety response.

Jones et al., (1994) examined ‘intensity’ and ‘direction’ of anxiety symptoms among elite (n = 97) and non-elite (n = 114) competitive swimmers using modified version of the Competitive State Anxiety Inventory-2 during the period preceding an important race. The findings showed that there was no difference between the two groups on the intensity of cognitive and somatic anxiety symptoms, but that elite performers interpreted both anxiety states as being more facilitative to performance than the non-elite performers. Furthermore, self-confidence was higher in the elite group. Further analyses investigated differences between those swimmers who reported their anxiety as debilitative and those who reported it as facilitative in the elite and non-elite groups. These showed that anxiety intensity levels were higher in the debilitated than the facilitated swimmers in the non-elite group, but no such differences were evident in the elite group.
These findings provide further support for the distinction between intensity and direction of competitive state anxiety symptoms. They also emphasize the importance of skill level as an individual difference variable in the examination of the nature of the competitive anxiety response. Jones, et al., (1994) found that swimmers with debilitative interpretation of anxiety had higher intensity of anxiety than the participants who interpreted their anxiety as facilitative.

Hanton et al., (2000) examined intensity and direction, i.e., interpretation of intensity as facilitative or debilitative, of anxiety symptoms as a function of two types of sport. The types of sport were explosive (rugby league) versus fine motor skills (target rifle shooting). The sample comprised fifty male rugby league participants and fifty target rifle shooters who completed a modified version of the Competitive State Anxiety Inventory-2 prior to competition. Contingency analysis yielded a significant difference in the number of rugby players who reported somatic anxiety as facilitative and the number of rifle shooters who reported somatic states as debilitative. No such differences were evident for cognitive anxiety. Analysis of variance indicated no differences between the two groups on the intensity of cognitive and somatic anxiety, but the performers competing in rugby league interpreted both states as being more facilitative to performance; the rugby league players also had higher scores on self-confidence than the shooters. These findings provide continuing support for the measurement of directional perceptions of competitive anxiety.

Robazza and Bortoli (2003) examining the intensity and direction of cognitive and somatic anxiety across a range of individual and team sports found
that elite athletes reported lower levels of cognitive and somatic state anxiety symptoms, and experienced those symptoms as less debilitative than those of non-elite athletes. Thus indicating intensity and the direction of cognitive anxiety and somatic state anxiety could differentiate performance levels.

Rokka et al., (2011) evaluated the levels and gender differences in intensity and direction of the competitive state anxiety in junior handball players prior to a competition and to investigate any possible differences between male and female players, as well as in relation to their athletic experience. The sample of the study consisted of hundred and fifteen handball players, members of eight handball teams (four male and four female), which participated in the Greek Junior Handball Championships finals held in Athens in 2008. Self confidence and anxiety intensity and direction were evaluated using Competitive State Anxiety Inventory-II (CSAI-II, Martens et al., 1990; Jones and Swain, 1992) thirty minutes before the competition.

The results showed that male junior handball players reported lower scores of cognitive anxiety, which was facilitative to performance. On the other hand, females displayed a higher score in cognitive anxiety, which was rather debilitative to performance. Furthermore, junior male handball players displayed higher self-confidence, with positive effects on their performance, while female handball players stated lower self-confidence, which was neither facilitative nor debilitative to performance. In relation to years of experience, the results revealed that players with four to six years of experience showed higher self-confidence with facilitating direction, while players with less years of experience displayed lower
self-confidence, with neither facilitative nor debilitative effects on their performance.

To summarize, these studies provide evidence that the conventional notion of anxiety as negative towards performance can be questioned. Athletes with similar anxiety intensities were found to differ in their interpretation of cognitive and somatic anxiety. Many of the studies have reported elite athletes to have a more favourable direction of interpretation of anxiety although no such differences were found in intensities of anxiety.

Thus anxiety can be perceived as being pleasant or unpleasant and may not always have a negative impact depending upon the interpretation of the symptoms experienced in an individual (Jones and Hanton 2001). Burton and Naylor, (1997) have argued that negative affective states (e.g., anxiety) leading to debilitating effects on performance and positive affective states (e.g., challenge, excitement or self-confidence) that facilitate performance wrongly included in the CSAI-2 being viewed separately as either facilitative or debilitative respectively could be the reason Jones, and colleagues (Jones et al., 1994; Jones and Swain 1992; and Jones et al., 1993) found performers interpretation of anxiety symptoms to be more predictive of performance than the intensity of the symptoms experienced. Despite these limitations, the addition of directional scales to the CSAI-2- D has added considerably to the conceptualization and measurement of anxiety in sport.
2.6 Studies Related to Directional Interpretation of Anxiety-Performance Relationship

Jones *et al.*, (1993) examined the inter-relationships between intensity and direction dimensions of competitive state anxiety on beam performance for a sample of forty eight adolescent, female gymnasts. CSAI-2-D subscales were evaluated ten minutes prior to performing. In subsequent analyses, the gymnast’s performances were split at the median to delineate between good and poor performance groups. Results revealed no significant difference in cognitive and somatic anxiety intensity scores and on somatic anxiety direction scores between the two groups. The group with better performance, however, reported their cognitive anxiety intensity as being more facilitating and less debilitating to performance than the poor performance group. Stepwise multiple regression analyses did not provide support for the prediction that direction of anxiety would be more strongly related to performance than intensity, although it was found to be equally effective as a predictor variable. These findings provide a significant impetus for further research being the premier study to be conducted exploring anxiety-performance relationship using directional measures of anxiety.

Swain and Jones (1996) examined the relationship of intensity and direction of competitive state anxiety of ten Loughborough University men's basketball team on their performance. Competitive state anxiety was measured on modified CSAI-2 inventory that included a direction scale in which subjects rated the degree to which the experienced intensity was either facilitative or debilitating to subsequent performance twenty minutes prior to each of six league matches. The
objective measure of basketball performance developed by Sonstroem and Bernardo, (1982) was employed for the study. Polynomial trend analyses revealed an inverted-U relationship and accounted for 18.4% of the variance in case of cognitive anxiety intensity and a positive linear relationship that accounted for 23.4% of the variance for directional values. Somatic anxiety direction had a positive linear relationship with 17% variance as compared to somatic anxiety intensity which only explained less than 2%. The findings for self-confidence intensity revealed an inverted-U relationship and accounted for 21.2% of performance variance. The findings provide further evidence of the importance of assessing performer’s interpretations of the symptoms they are experiencing.

Edwards and Hardy (1996) explored the interactive effects of state anxiety intensity and direction on the performance of forty five (18-31 year old) netball players. Results indicated that direction explained no further variance in performance over and above intensity alone. They proposed that this may be partly because the directional scale has not as yet been validated, and is difficult for competitors to complete close to competition. They also suggested that the results they obtained may have related to their “all female” participant pool.

Kais and Raudsepp (2005) examined the relationship between intensity and direction of competitive state anxiety, self-confidence and performance in basketball and volleyball players prior to different matches. Male basketball (n=12) and volleyball players (n=12) completed a modified version of the Competitive State Anxiety Inventory-2 (CSAI-2) prior to eleven different matches, and a total of one hundred and thirty two questionnaires overall. The inventory
included an intensity subscale as well as direction sub-scale for somatic and cognitive anxiety.

The findings revealed a moderate level of state anxiety and very high self-confidence of the players before the matches. The cognitive and somatic anxiety and self-confidence were stable prior to the different matches. Correlation analysis showed that the intensity and direction of somatic and cognitive anxiety and self-confidence of the players were not related to their athletic performance. However, the intensity of cognitive anxiety was positively and moderately related to their athletic performance.

Sean et al., (2007) evaluated the relationships between the intensity and directional aspects of competitive state anxiety as measured by the modified Competitive Sport Anxiety Inventory-2(D) (Jones and Swain 1992) in a sample of twelve experienced male golfers. Anxiety and performance scores from identical putting tasks performed under three different anxiety-manipulated competitive conditions were used to assess both the predictions of Multidimensional Anxiety Theory (MAT; Martens et al., 1990) and the relative value of intensity and direction in explaining performance variance.

A within-subjects regression analysis of the intra-individual data showed partial support for the three Multidimensional anxiety theory hypotheses. Cognitive anxiety intensity demonstrated a negative linear relationship with performance, somatic anxiety intensity showed a curvilinear relationship with performance, and self-confidence intensity revealed a positive linear relation. Cognitive directional anxiety illustrated a positive linear relationship with putting
performance. Multiple regression analyses indicated that direction (42% of variance) was a better predictor of performance than intensity (22%)

To summarize, examining relationship between performance and directional interpretations have found equivocal results however findings were more consistent when comparing elite with non-elite performers (Hanton and Connaughton 2002; Jones et al., 1994; Jones and Swain 1992, 1995; and Mahoney and Avener 1977). The introduction of multidimensional approach and further the inception of interpretation of anxiety brought about a change in the identity of anxiety which was initially viewed as unidimensional and detrimental to performance. An opinion among anxiety researchers that subcomponents of anxiety were not independent of each other led many a researchers to look into the interaction between cognitive and somatic anxiety. This resulted in the culmination of many more theories viz, zones of optimal functioning (Hanin, 1980), reversal theory (Apter, 1982) and Hardy and Fazey, (1987) Catastrophe model that attempted to annihilate the problems in the established anxiety performance relationship.

2.7 The Mental Health Model

The mental health model was the premier theory that attempted to establish mood-performance relationship (Morgan, 1985). The model proposes an inverse relationship between psychopathology and sport performance (Morgan, 1985). Morgan found in his study athletes reported scores for Vigor above the 50th percentile of the published norms (McNair et al., 1971) and to report scores for Tension, Depression, Anger, Fatigue, and Confusion below the 50th percentile. He
referred to this pattern of scores as an iceberg profile and proposed that it reflected mental health (Morgan, 1985)

2.7.1 Studies Related to Mental Health Model of Mood States

Hassmén and Blomstrand (1995) conducted a study to test Morgan's prediction that an iceberg profile, characterized by Profile of Mood States (POMS) scores above the population norm on vigor and below the norm on tension, depression, anger, fatigue, and confusion, indicate successful performance. Nine female soccer players formed participants of the study. The players completed the profile of mood states (POMS) before, immediately after, and 2 hours after each game during a season. The outcome of the games greatly affected the players' mood states. Tension, depression, anger, and confusion scores were lower and vigor was higher when the team won. Prior to the games, only minor differences in POMS scores were detected, regardless of the actual outcome. Taken together, the results do not support the notion that POMS scores could be helpful in predicting team performance.

Miller and Miller (1985) used five self-report inventories in a field-based setting with twenty elite netballers to see if they could discriminate between the successful and unsuccessful members of the squad. Subjects were divided into successful (n=12) and unsuccessful (n=8) groups. Twelve of these subjects participated in the World Tournament. Mean results for each group on each variable measured by the different questionnaires (Sport Competition Anxiety Test, both forms of the State-Trait Anxiety Inventory, the profile of Mood States and the short form of the Activation–Deactivation Adjective Check List) were
compared. No significant differences were found between the two groups on the psychological factors (tension, depression, anger, vigor, fatigue, and confusion) measured. Results indicate that by themselves, self-report questionnaires cannot be used for personnel selection purposes.

Covassin and Pero (2004) examined the relationship between self-confidence, anxiety, and mood states in collegiate tennis players. The Competitive State Anxiety Inventory--2 (CSAI-2) and the Profile of Mood States (POMS) were utilized based on their ability to assess a number of different psychological states thought to be crucial for proper mental preparation prior to athletic competition as well as for their psychometric properties. These inventories were employed to determine pre-competition levels of anxiety, self-confidence and mood disturbance and their relationship to successful or unsuccessful tennis match outcome. Twenty-four collegiate tennis players completed the POMS and CSAI-2, thirty minutes prior to their tennis match during their participation in the NCAA Regional (VII) Team Tennis Tournament.

Results revealed winning tennis players displayed significantly higher self-confidence, lower cognitive and somatic anxiety levels, and lower total mood disturbance scores than losing players. In addition, winning tennis players exhibited the iceberg profile on the POMS, which is consistent with the findings in similar research conducted with successful athletes in other sports. As such, athletes who displayed high self-confidence and low anxiety levels were potentially able to remain calm and relaxed under pressure and were not as affected
by negative events. Furthermore, these results suggest that mental state prior to the start of a tennis match plays a crucial role in overall success or failure.

Wilson et al., (1980) conducted a study on thirty males, ages 20–45 years that consisted of ten marathoners with at least two years of competitive experience; ten joggers with at least two years of continuous jogging and exercise participation and ten non exercisers who had no regular physical activity during the previous year. They completed the Profile of Mood States and adjective checklist. Marathoners and joggers reported less depression, less anger, less confusion, and more vigour than non exercisers. Marathoners also reported less fatigue and less tension than non exercisers. Marathoners and joggers did not differ significantly on reported fatigue and tension; however, marathoners had significantly less depression, anger, and confusion, and more vigour than joggers. Results suggest that not only should the type of activity be considered in planning exercise programs for positive mental health, but also that the amount of activity should be assessed.

Silva et al., (1985) conducted a study on forty seven candidates competing for the 1980 US Greco-Roman and thirty nine competing for the Freestyle Olympic Wrestling Teams. They were administered a test battery that included the Profile of Mood States, the State-Trait Anxiety Inventory, and the Sixteen Personality Factor Questionnaire (16 PF). Subjects also completed physiological and motoric testing that included grip strength, reaction time tasks, dynamic balance, and competitive wrestling performance.
Findings indicate that important psychological factors were a positive pre competitive affect and self-control, and ventilation and endurance were important physiological discriminating variables. Based on a combined model, nineteen variables were identified that provided for the accurate classification of 89.06% of the competitors. An exploratory factor analysis conducted on the combined model identified six factors (positive pre competitive affect, anaerobic capacity, excitatory response, discipline, emotional stability, and aerobic capacity) that accounted for 70.9% of the variance.

Beedie et al., (2000) conducted a meta-analysis of twenty nine published studies that used the Profile of Mood States (POMS) to investigate relationships between mood and athletic achievement or between mood and performance outcome. Results showed that effect sizes (ESs) for level of achievement were minimal (n= 15, Weighted Mean ES = 0.10, SD = 0.07), a finding consistent with a previous meta-analysis by Rowley, et al., (1995). Larger effects were found for performance outcome (n= 17, Weighted Mean ES= 0.31, SD= 0.12). Effects were moderate for vigor, confusion, and depression, small for anger and tension, and very small for fatigue. All effects were in the direction predicted by Morgan’s, (1985) mental health model. Effects were larger in sports of short duration, in sports involving open skills, and where performance was judged using self-referenced criteria. Findings suggest that the POMS has utility in the prediction of performance outcome but not in the prediction of level of achievement.
Craighead *et al.*, (1986) examined the personality characteristics of sixty-one basketball players, starters and non starters from one high school female team, and two university male teams, using the Profile of Mood States (POMS). Secondary differences between sex, race, level of education, and type of season (winning or losing) were explored. The POMS was administered to the subjects just before the basketball season. Although no significant differences were found between starters and non starters, comparisons between sexes, races, and levels of education indicate differences on some of the mood factors.

In conclusion, winning players were more self-confident and had lower anxiety and mood disturbance scores prior to their matches than the losing players. Athletes who displayed high self-confidence and low anxiety levels were potentially able to remain calm and relaxed under pressure and were not as affected by negative events. The ability to get into the right mindset prior to competition and then maintain it throughout the match may be a key aspect of the game that separates the successful from the unsuccessful athletes. Players who demonstrate low self-confidence and high anxiety prior to the start of their match may be placing themselves at such a mental disadvantage that they are unable to overcome it regardless of how the match progresses. Furthermore, these results suggest that mental state prior to the start of a tennis match plays a crucial role in overall success or failure.

Hoffman *et al.*, (1999) examined the relationship between the Profile of Mood States (POMS) and performance in a professional basketball team. Seven male professional basketball players playing for the defending champions of the
Israel Basketball League participated in this study. The POMS was administered seven times during the season. The initial POMS administration was performed three weeks following the start of preseason practice and one day prior to the first basketball game. Each of the other POMS administrations were performed two days following a game and no more than two days before the next game.

Typical iceberg profiles were observed during test 1, test 2 and test 3 which coincided with successful performance (winning percentages greater than 60% between each POMS administration). Subsequent decreases in performance between Test 3 and Test 4 (a 33% winning percentage) resulted in a decrease in vigor and an increase in anger. As team performance improved between Test 4 and Test 5 (winning percentage again above 60%), vigor returned to its original level. However, the mood states anger and depression remained elevated, even during successful team play. These results suggest that the mood state vigor may be reflective of team performance. In addition, mood states appear to be influenced more by performance or experience, rather than performance being influenced by changes in mood states.

Terry and Slade (1995) found support for Morgan’s iceberg profile. They conducted a study on male Shotokan karate players (karateka) (N = 208). They completed the Competitive State Anxiety Inventory-2 and the profile of mood states about forty minutes before a competition. Single-factor multivariate analysis of variance of pre performance mood and anxiety scores indicated significant differences between winning and losing competitors. Winners scored higher on vigour, anger, and self-confidence, and lower on tension, depression, fatigue,
confusion, cognitive anxiety, and somatic anxiety. Discriminant function analysis showed that 91.96% of participants could be correctly classified as winners or losers on the basis of pre performance mood scores. This figure rose to 93.47% when scores on the anxiety subscales were also included in the discriminant function analysis. Anxiety scores alone produced 78.89% discrimination. Mood profiles for winning karateka were in line with the "mental health" profile of Morgan except for above-average scores on anger.

This result supports the view of McGowan and Miller that anger may facilitate performance in karate competition. The capacity of measures of psychological state to discriminate performance exceeds previous reports, suggesting that karate performance may be exceptionally mood-dependent. These results suggest that interventions which increase scores on vigour and anger and reduce scores on tension, depression, fatigue, and confusion may be particularly efficacious for Shotokan karate performance.

Terry and Young’s (1996) in a study with field hockey players (N = 128) reported that psychological state measures decline in predictive effectiveness in long duration, open skill team sports. Participants completed the Competitive State Anxiety Inventory-2 and the profile of mood states about forty five minutes before a British Universities’ trial. Single-factor multivariate analysis of variance indicated no significant differences between selected and non selected players for any pre performance mood or anxiety measure. Discriminant function analysis showed that seventy four participants (57.81%) could be correctly classified as selected or non selected players on the basis of pre performance mood scores. This
Review of Related Literature

Lane and Chapell (2001) examining the relationship between pre-competition mood and performance at the World Student Games basketball competition found that mood accounted for only 9% of performance variance. The purpose of the study was to compare mood and performance relationships using an idiographic (within-subject) design with mood and performance relationships using a cross-sectional (between-subject) design. Players from the United Kingdom basketball team (N = 10) completed the 24-item profile of mood states-Adolescents (Terry, et al., 1999) one hour before competition for eight games. Participants completed a Performance Satisfaction Questionnaire one hour after each game. Results indicated that the predictive power of mood was highly individualized. Within-subject analysis identified five players whose mood significantly related to performance.

Data from these five players were grouped, and regression analysis on this group indicated that mood significantly predicted 40% of performance variance. By contrast, mood showed no association with performance in the five other players. Multiple regression on data from all ten players indicated mood accounted for only 9% of performance variance.

Rowley et al., (1995) conducted a meta-analysis on thirty three studies comparing the POMS scores of athletes differing in success to estimate the magnitude of the findings. The overall effect size was calculated to be 0.15.
Although this value was significantly different from zero, the amount of variance accounted for was less than 1%. The results suggest that across many different sports and levels of performance, successful athletes possess a mood profile slightly more positive than less successful athletes. However, with such a small and non-robust effect, the utility of the POMS in predicting athletic success is questionable.

Thelwell et al., (2006) in his study investigated relationships between game location, performers' experience, and mood states. Thirty-one experienced collegiate soccer players completed the Brunel Mood Scale to assess anger, calmness, confusion, depression, fatigue, happiness, tension, and vigor before eight competitive games (four home and four away). Participants were categorized into experienced and less experienced groups, based on the level of performance at which they played. Repeated-measures multivariate analyses of variance compared mean mood scores across location and experience, and follow-up univariate analyses suggested the increase in mood scores on tension and decrease in scores on calmness, happiness, and vigour between playing away and at home were significantly greater for less experienced soccer players than experienced players.

Terry and Munro, (2008) assessed the capacity of pre-competition mood and anxiety scores to predict tennis results. A sample of ninety-two social-competitive tennis players (49 men and 43 women, mean 39.7 years, range - 19-62) completed the Brunel Mood Scale (BRUMS) and the revised Competitive State Anxiety Inventory-2 (CSAI-2R) prior to weekly competitions, producing a data set of five hundred and sixty seven matches. Discriminant
function analysis showed that the outcome of matches could be correctly
classified with 60% accuracy. Consistent with theoretical predictions, low scores
for confusion, depression, tension, anger, and cognitive anxiety, and high scores
for self-confidence were significant predictors of winning performances. Using
the two measures independently, the BRUMS provided 56.8% correct
classifications and the CSAI-2R provided 58.7%.

Results indicated that a much higher proportion of winners (78.5%) than
losers (38.3%) were correctly classified from mood scores, suggesting greater
potential for predicting winning performances from positive moods than losing
performances from negative moods. Results were generally consistent with
Morgan’s mental health model and Martens’ multidimensional anxiety theory,
and can be used to inform interventions applied by sport psychologists with
tennis players

To summarize, mental health model (Morgan, 1985) was the first theory
that attempted to explain mood performance relationship. Research on mood
performance relationship testing mental health model theory has been inconsistent.
This has been attributed to methodological inconsistencies such as conducting
inter and intra individual studies, usage of associated tables of normative values
that was derived from psychiatric outpatients and normal college students and the
usage of differing response set as instructional for POMS.
2.8 The Conceptual Model

The conceptual model (Lane and Terry 2000) is one of the recent models that have been successful in explaining the mood-performance relationships. The basic premise of the model is that mood dimensions interact to influence performance. The model predicts that depressed mood acts as a catalyst for reduced vigor and increased anger, confusion, fatigue and tension, thereby debilitating performance. It explains both the relation of the different mood stages between each other and the link between these dimensions and sports performance, placing special emphasis on the modulating role supposedly played by the depressed mood state (Lane and Terry 2000; Lane, et al., 2001).

The model proposes four testable hypotheses. The first is that anger, confusion, fatigue and tension will be higher and vigour will be lower among athletes experiencing depressed mood than those experiencing no symptoms of depression. The second hypothesis is that inter-relationships among anger, confusion, fatigue, tension and vigour will be stronger for athletes experiencing depressed mood. Lane and Terry, (1998), Lane, et al., (1999); found strong support for these two hypotheses. The third hypothesis is that vigour will facilitate performance, and confusion and fatigue will debilitate performance, regardless of the presence or absence of depressed mood. The fourth hypothesis is that anger and tension will debilitate performance among individuals reporting symptoms of depression, whereas anger and tension will show a curvilinear relationship with performance among individuals reporting no symptoms of depression.
2.8.1 Studies related to the conceptual model

Lane et al., (2001) tested the conceptual model of mood-performance relationships (Lane, and Terry 2000) which proposed that depressed mood would influence the intensity and inter-relationships of other mood responses and moderate the anger-performance and tension-performance relationships. To promote ecological validity, the model was tested in a field setting using a cross-sectional design. A sample of four hundred and fifty one schoolchildren (M= 12.4 yrs., SD= 1.3 yrs.) completed the profile of mood states - adolescents (POMS-A: Terry, et al., (1999) and stated a performance goal, approximately ten minutes before a running event. Participants were divided into a depressed mood group (n= 273) and a no-depression group (n= 178) on the basis of responses to the POMS-A depression subscale.

The depressed mood group reported higher scores for anger, confusion, fatigue, and tension, and lower scores for vigour. Inter-correlations among these mood dimensions were stronger in the depressed mood group, who set easier goals and performed less well. Vigour was associated with facilitated performance regardless of depression. Anger was associated with debilitated performance in the depressed mood group and with facilitated performance in the no-depression group. Some support was shown for a moderating effect of depressed mood on the tension-performance relationship. The hypothesised curvilinear anger-performance and tension-performance relationships in the no-depression group did not emerge. The Lane and Terry model was generally, but not totally, supported.
Cockerill et al., (1991) used the POMS inventory as a predictor of cross-country running performance among a group of experienced male athletes. Race times from two competitive events were plotted against each of six mood factors. Using data from race 1, a multiple-regression model, incorporating the interdependence of tension, anger and depression was able to predict rank order of finishing positions for race 2 with acceptable accuracy ($r_s = 0.74$, $P$ less than 0.01). They reported that it is likely that in sports where demands on athletes are very different from those made upon cross-country runners, an alternative model may be required.

Ruiz and Hanin, (2004a) examined content and intensity of anger prior to, during, and after best ever and worst ever performances in forty three high-level Spanish karate athletes using individualized anger profiling. Optimal and dysfunctional anger intensities were assessed using a modified version of Borg’s Category Ratio (CR-10) scale. Anger profiling was supplemented with positive and negative emotion profiling. As expected, content of anger descriptors was highly idiosyncratic. Moreover, great variability in optimal and dysfunctional anger intensities was found at individual and group levels. In best performances, anger was related to the generation of additional energy, whereas in worst performances, anger resulted from a perceived lack of resources or low readiness to perform. Athletes generated different anger descriptors in performance and in non-sport performance situations (overlap ranged from 0 to .35). The results support the use of an idiographic approach in the study of anger states.
Robazza and Bortoli (2007) conducted a study to assess rugby players’ perception of the facilitative or debilitative effects of trait anger symptoms. A cross-sectional study design was employed using normative measures of anger and anxiety. The frequency and direction of symptoms of competitive trait anger were assessed in one hundred and ninety seven Italian rugby players together with the intensity and direction of multidimensional trait anxiety. Findings revealed a general tendency of rugby players to experience a moderate frequency of anger symptoms and to interpret their symptoms as facilitative rather than debilitative. Regarding the direction of symptoms, cognitive anxiety was a significant predictor of anger, while self-confidence was a significant predictor of control of anger.

Wong et al., (2006) found partial support for the conceptual model of Lane and Terry, (2000) in a study on Karate athletes (72 males and 37 females) of 2004 Malaysian Games testing Lane and Terry’s conceptual model. The athletes were divided into winners (medalists) and losers. The Brunel Mood Scale (BRUMS) was administered prior to the start of competition. MANOVA was employed to treat the data, while Pearson correlations were calculated for mood states in each depressed mood group and by gender. In terms of non-depressed and depressed mood, tension and fatigue were higher in the females in the depressed group. Tension and anger were higher in the males in the non-depressed. The highest associations among mood subscales were between anger and depression and between depression and fatigue in depressed males. The female winning karateka scored higher on anger. The highest correlations between mood dimensions in
depressed females were between depression and anger and between depression and confusion.

Contrary to previous research on the influence of depression on anger, only the female winners scored higher on anger. Several negative mood dimensions were higher in both male and female depressed groups, lending some support to the conceptual model advanced by Lane and Terry.

To summarize, Conceptual model (Lane and Terry 2000) was conceived to bring more clarity in the mood performance relationship. The model posits major influence of depression on other mood states on athletic performance outcome. A number of researchers have found partial support for the model.

2.9 Applied Anxiety Management in Sport

Mental techniques used to develop psychological skills in task performance may be separated into two basic approaches, cognitive and somatic (Behncke, 2004). Progressive Muscle Relaxation, Autogenic Training and Meditation are some of the somatic techniques that begin with concentrating on physical sensation to heighten attention of the perception of movement or non-movement (Prentice, 1998). Cognitive methods include mental rehearsal, mental imagery and visualization, visuo-motor behaviour rehearsal and cognitive-behaviour therapy (Behncke, 2004). Cognitive and somatic techniques are thought to interrelate on the notion that attainment of appropriate psychosomatic states is essential for cognitive based strategies to become effective for performance enhancement (Sadeghi et al., 2010).
The basic mental techniques predominantly used in sport psychology interventions are imagery, goal-setting, self-talk and physical relaxation techniques (Vealey, 2007). “Psychological skills” and “mental techniques” are commonly used interchangeably with regard to psychological skill training (Birrer and Morgan 2010). Psychological skills are the desired outcome (Vealey, 2007) while psychological methods or techniques are the means to promote the desired outcomes through the systematic application of techniques. Psychological skills are the learned behaviours used by athletes to regulate their athletic performances (Murphy and Tammen 1998). Self-confidence, arousal control, motivation, interpersonal skills, and coping with injury are some of the psychological skills needed for enhancing performance (Thomas, 1990).

2.9.1 Studies Related to Applied Anxiety Management in Sport

Behncke (2004) reviewed mental skills training for sport in relation to general cognitive-somatic techniques. These techniques include mental rehearsal, mental imagery and visualization, visuo-motor behavior rehearsal, cognitive-behavior therapy, biofeedback, progressive muscle relaxation and meditation. He reported that the initial and continued ability to self-monitor, though enhanced by mental skills training, is fundamentally important for any implementation of cognitive-somatic therapy.

Sadeghi et al., (2010) conducted a study to identify the mental skills training needed most by the university soccer players. Eight male university football players (aged 25 to 36) from one large university in Kuala Lumpur ten years of playing experience were participants of the study. The interview
transcripts were hierarchically content analyzed to identify the themes. The findings revealed imagery, goal setting, self-talk, and relaxation as the most needed psychological skill training by the respondents.

Birrer and Morgan (2010) conducted a comprehensive review of psychological skill training in elite sports, with a special focus on high-intensity sports. The reviewed literature showed a lack of convincing evidence and theoretical underpinning concerning traditional psychological skills to enhance performance in high-intensity sports. Henceforth they presented a model with three conceptual levels (psychological demands, skills and techniques). The model facilitates the identification of the psychological demands of a specific sport, which in turn enables distinguishing which psychological skills are required. This allows an expert to choose psychological techniques to improve the athlete’s psychological skill.

They found that self-skills, personal development and life skills, arousal-regulation skills, volitional skills, motivational skills and recovery skills as the most important skills to address in order to enhance performance. Development of harmonious passion, in-practice integration of volitional strategies, use of associative attentional techniques, pain management techniques, use of the mindfulness-acceptance approach and the facilitative interpretation of cognitive and somatic sensations were considered suitable to meet the psychological demands of high-intensity sports.

Hanton and Jones (1999) conducted a study extending previous findings that elite performers, compared to non elite performers, interpret their
pre performance cognitive and somatic anxiety symptoms as more facilitative than debilitating to performance (Jones et al., 1994; Jones and Swain 1995). In-depth interview techniques were employed to investigate the cognitive skills and strategies underlying elite swimmers' interpretations of their pre-race thoughts and feelings. Participants were ten male elite swimmers who consistently maintained facilitative interpretations. Data were drawn from verbatim transcripts and were inductively content analyzed. Four general dimensions traced the acquisition and development of the cognitive skills and strategies underlying facilitation from early competitive experiences to the present day.

It was concluded that participants' skills and strategies were acquired via natural learning experiences and various educational methods. These results extend the research literature on facilitative anxiety by identifying and clarifying the mechanisms underlying the phenomenon.

Weinberg and Comar (1994) conducted a meta-analysis of studies on the use of psychological interventions in competitive sport to enhance performance. Thirty-eight of the forty-five studies examined (85%) had found positive performance effects, although causality could only be inferred in twenty of these studies. These interventions could be classified as relaxation-based, cognitive, cognitive-behavioural or behavioural in nature. Although general support was provided for the effectiveness of psychological interventions in competitive sports, a number of methodological shortcomings limit the application of the findings.

Their study suggests that future intervention research in competitive sport should employ more detailed manipulation checks, include follow-up assessments
beyond a mere post-test, include placebo-control groups to control for expectancy
effects and include more diverse samples.

2.10 Progressive muscular relaxation

Progressive muscle relaxation originated from the theory that a
psychobiological state called neuromuscular hypertension is the basis for a variety
of negative emotional states and psychosomatic diseases (Jacobson, 1938).
Jacobson asserted that relaxation of muscles would lead to relaxation of the mind,
“as an emotional state fails to exist in the presence of complete relaxation of the
peripheral parts involved” (Jacobson, 1938).

The protocol for employing PMR generally involves sitting in a
comfortable position and working through the contraction and release of various
muscle groups, often starting with larger muscle groups. The participant is
encouraged to practice tensing each muscle group until they recognise the feeling
of even the slightest contraction, and then they learn to release it. After mastering
relaxation in a seated position, they are taught how to relax muscles in real life
situations. The use of PMR often entails minimising tension in the muscles that are
required for some activity, whilst concurrently relaxing those muscles that are not
necessary to the enactment of the skill.

2.10.1 Studies related to progressive muscle relaxation

Weinstein and Smith (1992) compared the effect of isometric squeeze
relaxation (a variant of progressive relaxation) and meditation. Participants were
fifty two anxious subjects (16 men and 36 women). Meditation was found to
reduce state cognitive and somatic anxiety as well as increments in state focusing. Isometric squeeze relaxation reduced somatic anxiety and reported increments in focusing. Results suggest that isometric squeeze relaxation and progressive relaxation may be more appropriate for individuals who have difficulty focusing and meditation for those who already possess well-developed relaxation skills at a trait level. The results appear more consistent with Smith's cognitive-behavioural model of relaxation than with Benson's relaxation response or Davidson and Schwartz's specific effects models.

Conrad and Roth (2006) conducted a review of studies on Progressive muscle relaxation. This review describes the most common muscle relaxation therapy techniques, summarizes recent evidence of their effectiveness in treating anxiety, and explains their rationale and physiological basis. They concluded that although generalized anxiety disorder and panic disorder patients may exhibit elevated muscle tension and abnormal autonomic and respiratory measures during laboratory baseline assessments, the available evidence does not allow us to conclude that physiological activation decreases over the course of muscle relaxation therapy in generalized anxiety disorder and panic disorder patients, even when patients report becoming less anxious. Better-designed studies will be required to identify the mechanisms of muscle relaxation therapy and to advance clinical practice.

Ortiz (2006) conducted a study to determine if progressive relaxation techniques would improve sports performance in a group of female recreational golfers. The study was conducted over a three month period during which the
experimental group (n=9) regularly engaged in progressive relaxation techniques. Both the experimental group and the control group (n=9) played their regular golf game; recording their scores, putts per round, and number of greens hit in regulation. Pre intervention measures were recorded and compared with post intervention measures. Both groups recorded significant improvement on all three measures. The amount of improvement observed for the experimental group was more than that observed for the control group. The between-group differences were not, however, significant.

Navaneethan and Soundararajan (2010) investigated the effect of psychological skill training techniques such as progressive muscle relaxation on cognitive anxiety, somatic anxiety and self-confidence. These subscales of competitive anxiety were measures using the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Vealey and Burton 1990). The study consisted of twenty four male volleyball players from PSG College of Arts and Science, Coimbatore. Their age ranged from eighteen to twenty five years. Subjects were randomly assigned to either a relaxation training experimental group, or a no-relaxation training control group. Both the experimental groups were given training for three days a week and for six weeks in total. Paired t-tests were used to test the effect of treatment groups individually between pre and post tests of all the groups on variables used in the present study. The result of the study reveals that there was significant difference in 0.05 levels of competitive anxiety among the male inter-collegiate volleyball players.
Abouzekri et al., (2010) conducted a study to test the matching hypothesis, which contends that administration of a cognitive or somatic anxiety intervention should be matched to a participant's dominant anxiety response. Sixty-one male soccer players were assigned to one of four groups based on their responses to the Competitive State Anxiety Inventory-2, which was modified to include a directional scale. Interventions were randomly administered in a counterbalanced order ten minutes before each performance trial on a soccer skill test. The dominantly cognitive anxious group (n=17), the dominantly somatic anxious group (n=17) and the non-anxious control intervention group (n=14) completed a baseline performance trial. The second and third trials were completed with random administration of brief cognitive and somatic interventions. The non-anxious control group (n=13) completed three trials with no intervention. A mixed-model, group treatment multivariate analysis of variance indicated significant changes in cognitive anxiety intensity and somatic anxiety intensity, but not in state anxiety direction or performance time or accuracy. They did not find support for the matching hypothesis for state anxiety intensity and direction or for performance.

Rajan and Pushparajan (2011) examined the effect of relaxation training on subscales of competitive state anxiety (CSAI-2; Martens, et al., 1990). Twenty four athletes from PSG College of Arts and Science, Coimbatore, age ranging eighteen to twenty five years formed subjects of the study. Subjects were randomly assigned to either a relaxation training experimental group, or a no relaxation training
control group. Both the experimental groups were given training for three days a week and for six weeks in total.

Study findings did not reveal statistical significance for the overall a-state anxiety levels between the relaxation training experimental group and the control group. There was statistically significant difference between, the groups for somatic anxiety. However, the mean scores of cognitive anxiety relaxation group exhibited a greater decrease from trait to state compared to the control group. Paired t-tests employed to test the effect of treatment groups individually between pre and post tests of all the groups on CSAI-2 subscales revealed significant difference in 0.05 levels of competitive anxiety among the athletes.

Maynard et al., (1995) evaluated the effect of a somatic intervention technique. Subjects (N = 17) completed a modified version of the Competitive State Anxiety Inventory 2 (CSAI-2), which assessed both intensity and direction (debilitative-facilitative) of state anxiety within one hour of a soccer league match. During the match, player performances were evaluated using intra individual criteria. Subjects were allocated to control (n = 8) and experimental (n = 9) groups on the basis of their somatic anxiety intensity and direction scores. Following an 8-week intervention, subjects were again assessed during a second soccer match. A series of two-way analyses of variance with one repeated measure revealed significant interactions for cognitive anxiety intensity, somatic anxiety intensity and somatic anxiety direction. This study provided further support for the "matching hypotheses" in that a compatible treatment proved most effective in reducing the targeted anxiety.
Maynard et al., (1995) in a similar study evaluated the effects of a cognitive intervention technique and to further examine the anxiety-performance relationship in semi professional soccer players. Participants completed a composite version of the Competitive State Anxiety Inventory-2 (CSAI-2) twenty minutes before three soccer league matches. Two experimental groups, one suffering from debilitative cognitive anxiety (n = 8), one suffering from debilitative somatic anxiety (n = 8), undertook a twelve week cognitive intervention. Player performances were evaluated using intra individual criteria. A series of two-way analyses of variance (group and event), with repeated measures on the second factor, indicated significant group-event interactions for cognitive anxiety intensity and direction, and somatic anxiety intensity and direction, yet failed to reveal significant interactions or main effects for the performance measures. This study provided partial support for the "matching hypothesis" in that a compatible treatment proved more effective in reducing the targeted anxiety in both experimental groups.

Khanna et al., (2007) conducted a study to compare the effectiveness of biofeedback training and progressive muscle relaxation training in reducing blood pressure and respiratory rate among highly stressed individuals. Thirty highly stressed female subjects were selected for the study after administering Comprehensive Test (CAT) to one hundred and twenty females. Only those who scored more than forty and percentile more than seventy were chosen for the study. Twenty subjects each were randomly assigned to either biofeedback training or progressive muscle relaxation training and ten subjects formed the control group. The experimental groups were trained in their respective interventions for a period
of ten consecutive days for ten minutes daily. Paired t test for analysing the pre and post test and unpaired “t” test to find the difference in readings of the subjects of two experimental groups versus control group and also to find the difference among two training groups were employed. There was no significant difference among the three groups for pre test.

Results showed that PMR training led to significant improvement in systolic and diastolic blood pressure and Bio feedback training resulted in improvement in respiratory rate. Hence it was concluded that both PMR and Bio feedback training may be used to reduce stress.

Gill et al., (2004) examined the effects of Benson's relaxation method and progressive relaxation. Participants were seventy six undergraduate university students. State anxiety was using a modified version of the Competitive State Anxiety Inventory-2 Results suggested that both relaxation techniques were effective in reducing cognitive and somatic anxiety, and elevating self-confidence. However, contrary to the predictions of the multi-process theory, there were no significant differences between the effects of either technique.

2.11 Autogenic training

Autogenic training (AT) is a psycho physiological form of psychotherapy using passive concentration and certain combinations of psycho-physiologically adapted stimuli (Kanji, 1997). Heaviness and warmth, relaxed breathing and a cool forehead is elicited by mental repetition of brief verbal phrases directing attention to specific bodily areas to achieve a relaxed state (Sadock and Sadock 2003). The verbal phrases influence the subconscious in a relaxed state (Hillmann, 2002).
Linden, (1990) describes AT as the most widely prevalent self-regulation therapy in the treatment for psychosomatic disease where stress, tension and anxiety play a big part (Bowden, 2002). It is a well-established relaxation technique and psychotherapy tool (Perlitz et al, 2004). This system of mental training has been found to be highly effective, not only in a wide range of psychosomatic and emotional disorders, but also as a powerful method in daily life for reducing the adverse effects of stress and the need for psychotropic drugs, while improving performance in a variety of situations from long-distance flying to competitive sport (Carruthers, 1984).

2.11.1 Studies related to Autogenic training

Hurgobin, (2006) investigated the effectiveness of Autogenic Training (AT) a relaxation technique, as a preventive measure against anxiety and as a technique to promote psychological well-being among students from the University of Zululand. It was hypothesised that AT would decrease anxiety and increase psychological well-being. The experimental group consisted of eleven post graduate psychology students who received AT weekly for a period of ten weeks. The control group comprised of a friend of each participant in the experimental group. Beck Anxiety Inventory and the Scales of Psychological Well-being were administered to both groups prior to and immediately after the ten weeks intervention. Data from the questionnaires were analysed quantitatively using the Statistical Package for the Social Sciences (SPSS). Participants' evaluations of their subjective experiences of Autogenic Training were studied qualitatively analysed.
The results of the study showed a significant reduction in anxiety within the experimental group over time. In addition, there were significant increases in total psychological well-being. The experimental group also reported a feeling of being in control, increased energy levels, clarity of thoughts, better control over emotions, deeper relaxation and improved self-awareness.

Groslambert et al., (2003) investigated the effects of autogenic and imagery training on postural control, heart rate, and the shooting performance. Sixteen expert biathletes belonging to the French national team (12 men and 4 women, mean age = 21.5 years, mean experience in biathlon = 6 years) participated in this study. They were randomly assigned to an experimental \((n = 8)\) or a control group \((n = 8)\). The experimental group were given autogenic and imagery training along with standard instruction in classical shooting training. The control group received standard instruction in classical shooting training. Both the groups were trained for twenty four hours during six weeks.

Results revealed that biathletes who received the autogenic and imagery training program improved significantly more in their stability hold than those with a classical shooting training program. Significant difference in between groups was not found for shooting performance and heart rate.

Autogenic Training is a psycho physiological form of psychotherapy using passive concentration and certain combinations of psycho-physiologically adapted stimuli (Kanji, 1997). Heaviness and warmth, relaxed breathing and a cool forehead is elicited by mental repetition of brief verbal phrases directing attention to specific bodily areas to achieve a relaxed state (Sadock and Sadock 2003).
verbal phrases influence the subconscious in a relaxed state (Hillmann, 2002). Although studies recently conducted on the effects of autogenic training on concomitants of athletic performance were not found, its favourable effects have been recorded earlier. Luthe and Schultz, (1969) found that regular practice of autogenic training had favourable effects on a range of sports. Carruthers, (1979) and Kanji, (1997) found Autogenic Training leads to better co-ordination and endurance, faster recuperation and a reduction of emotional upsets that tend to occur before important events.

2.12 Studies related to Breathing technique (pranayama)

Bhargava, et al., (1988) examined the autonomic responses to breath holding among twenty healthy young men. Breath was held at different phases of respiration and parameters recorded were breath holding time, heart rate systolic and diastolic blood pressure and galvanic skin resistance. After taking initial recordings all the subjects practised Nadi-Shodhana pranayama for a period of four weeks. At the end of four weeks same parameters were again recorded and the results compared. Baseline heart rate and blood pressure (systolic and diastolic) showed a tendency to decrease and both these autonomic parameters significantly decreased at breaking point after pranayama breathing. Thus pranayama breathing exercises appear to alter autonomic responses to breath holding probably by increasing vagal tone and decreasing sympathetic discharges.

Bhavanani et al., (2003) conducted a study to determine if mukh bhastrika (a yogic technique in which breath is actively blasted out in “whooshes” following
a deep inspiration) has any effect on central neural processing by studying its effect on reaction time reaction time (RT). (RT) is an index of the processing ability of the central nervous system and a simple means of determining sensory-motor performance. Twenty two healthy schoolboys who were practicing yoga for the past three months were recruited for the present study. Visual reaction time (VRT) and audio reaction time (ART) were recorded before and after nine rounds of much bhastrika. Mukh bhastrika produced a significant decrease in VRT as well as ART. A decrease in RT indicates an improved sensory-motor performance and enhanced processing ability of central nervous system. This may be due to greater arousal, faster rate of information processing, improved concentration and/or an ability to ignore extraneous stimuli. This is of applied value in situations requiring faster reactivity such as sports.

Campbell et al., (2004) conducted a study incorporating breathing techniques (prânâyâma), exercises for strength, vitality, and flexibility (âsanas) and guided relaxation (yoga-nidrâ). Psychometric testing was carried out to assess symptoms of stress, anxiety, and depression across three groups: regular yoga practitioners, beginners entering the program, and people who did not practice yoga. These tests were re-administered after six weeks. At the end of six weeks, the yoga beginners group showed lower average levels of symptoms of depression, anxiety, and stress than at commencement, but levels were stable for regular yoga practitioners and people who did not practice yoga.

Kapoor et al., (2008) in a study aimed at finding out the effect of combination of Pranayama and Kriya on the performance of shooters in terms of
breath-holding time, lung-function status and shooting performance. We studied fifty shooters of the Indian Army (age 20-30 years). Out of them, thirty shooters were given training in the techniques of Pranayama and Kriya for three weeks. The rest served as control. Variables were measured before and after the training in both the groups. We found highly significant improvement in all the three variables. So we concluded that Pranayama and Kriya are efficacious for better performance of shooters.

Garza and Ford (2009) evaluated the effect of breathing technique intervention strategy in the management of performance anxiety. Four members of 2008 NCAA Division I collegiate softball team ranging from 18 to 21 years of age formed subjects for the study. The study incorporated Ungerleider’s breathing technique, a regimen that involves breathing using the diaphragm. The intervention was given for three weeks. The strategy focused on the effects of the breathing technique on the participants’ heart rates, in relation to daily anxiety events; a heart rate monitor and anxiety logs were used to obtain data. Measures of the athletes’ heart rates showed that two players exhibited a decrease in heart rate, whereas two others did not. However all of them were able to use the breathing technique to decrease heart rate at some point during the implementation and program phases of the study.

Paul et al., (2010) compared the effects of deep breathing and sudarshan kriya in decreasing anxiety by improving autonomic function by changing sympathetic or parasympathetic activity among young volunteer’s male volleyball players in the age group of 19 – 23 yrs. Forty university level male volleyball
players were randomly assigned into three groups: Group – I: Control group in which no intervention was given; Group - II: Deep Breathing group and Group - III: Sudarshan Kriya group. Deep breathing and sudarshan kriya group were practiced for one month. Comprehensive Anxiety Test (CAT) questionnaire score, alpha-EEG and heart rate were measured before the intervention and one month later prior to a competition. Results revealed both deep breathing and sudarshan kriya brought about consistent pattern of pre competitive relaxation changes reflected in scores of CAT questionnaire, alpha-EEG activity and heart rate as compared to control group. Significant changes were not observed on comparing in Deep Breathing and Sudarshan Kriya groups but mean score shows that Sudarshan Kriya is more effective then deep breathing group in reducing pre competitive anxiety.

2.13 Imagery

Imagery, in the context of sport, may be considered “as the voluntary or involuntary creation or re-creation of an experience generated from memorial information, involving quasi sensorial, quasi-perceptional, and quasi-affective characteristics which may occur in the absence of the real stimulus antecedents normally associated with the actual experience and which may have physiological and psychological effects on the imager” Modified version of Morris et al., (2005) definition by (Weibull, 2005). Imagery is assessed in terms of its cognitive and motivational attributes. Watt et al., (2002) as cited in Morris et al., (2005) has defined imagery use as “the manner in which people imagine themselves in ways
that can lead to learning and developing skills and can facilitate performance of those skills”. Imagery ability has been defined as “An individual’s capacity of forming vivid, controllable images and retaining them for sufficient time to effect the desired imagery rehearsal” (Morris, 1997).

2.13.1 Studies related to imagery

Gordon et al., (1994) compared the effectiveness of an internal versus external imagery training program on performance of cricket bowlers (pitchers). Subjects (N=64) were high school students involved in a cricket studies curriculum. Based on baseline assessments of bowling (pitching) performance, subjects were matched and then randomly assigned to one of three conditions, (a) internal imagery training, (b) external imagery training and (c) control group. Both internal and external imagery training groups received ten minutes of training specific to their condition prior to each of six physical practice sessions over a three week period. After practicing their use of internal and external imagery during physical practice, each subject was instructed to use his specific imagery orientation prior to the performance of twelve pitches at the end of each of the six practice sessions. Control subjects simply viewed instructional videos for ten minutes prior to each practice with no mention of imagery.

Results from a three (imagery condition) for six days of three blocks of trials revealed that although all groups improved over time, there were no significant performance differences between the imagery groups. Results from the post experimental questionnaire indicated that although subjects did practice and
utilize their specific imagery orientation, approximately 50% found themselves switching between internal and external imagery.

Nordin and Cumming (2005) examined the effect of imagery direction on self-efficacy and performance in a dart throwing task. Two imagery types were investigated: skill-based cognitive specific (CS) and confidence-based motivational general-mastery (MG-M). Seventy-five novice dart throwers were randomly allocated to one of three conditions: (a) facilitative imagery, (b) debilitative imagery, or (c) control. After 2 imagery interventions, the debilitative imagery group rated their self-efficacy significantly lower than the facilitative group and performed significantly worse than either the facilitative group or the control group. Efficacy ratings remained constant across trials for the facilitative group, but decreased significantly for both the control group and the debilitative group. Performance remained constant for the facilitative and the control groups but decreased significantly for the debilitative group.

MacIntyre and Moran (2007) explored meta-imagery processes and imagery direction (i.e., facilitative or debilitative) in elite sports performers using qualitative methodology. The sample comprised seven participants from motor-sport, rugby, fencing and golf (mean age = 24.43 years; SD = 1.99). Results showed evidence of meta-imagery control skills being able, to restructure negative imagery so that it facilitates future performance. Some athletes reported deliberately imagining errors in order to prepare for “worstcase” scenarios in competition (hence using such imagery to facilitate their performance). Overall, we
propose that existing imagery use taxonomies need to be revised to take into account the flexibility with which elite athletes actually employ imagery.

Cutrone (1998) found that psychological skills package involving goal-setting and imagery improved the defensive skill performance in actual game situations. A single-subject multiple baseline across individuals design was utilized to assess the participants' game performance among four youth age basketball players. A skill utilized by the athlete in the defensive zone when an offensive player attempts to dribble the ball to the basket was used as the dependant variable for the study. The social validation assessment completed by the athletes clearly indicated that the treatment package was beneficial to all participants.

Nicholls et al., (2005), in a study with four high-performance amateur golfers, twelve week period individualized imagery interventions resulted in increase in mean global flow intensity in three of the four participants and increased mean global flow frequency among all four participants as measured by the Flow State Scale-2, and the Dispositional Flow Scale-2. The intervention also resulted in performance improvement as assessed via a participant-selected golf skill.

Radhakrishnan (2008) examined the effect of mental imagery training programme on selected psychological variables and skill performances of volleyball players. After administering MIQ-R (Hall), according to the imagery ability fifteen elite and fifteen novice players were selected as samples for the actual twelve weeks experimental (imagery) training programme. Another fifteen
elite and fifteen novice volleyball players served as control group. Somatic anxiety, cognitive anxiety, and self confidence were assessed by Competitive State Anxiety Inventory (CSAI-2). The skill performances were assessed following a four point rating scale by experienced and expert judges. The imagery training for the four skills was given according to latin square repeated measures design. For the purpose, four subjects each were grouped for each of the four skills, namely serve, pass (service reception), attack and block. Ten minutes general imagery and fifteen minutes specific imagery script was given repeatedly five to six times within fifteen minutes and then they were asked to open their eyes and relax. The pre and post tests on the selected psychological variables and skill performances were taken before and after the total duration of three and twelve weeks of mental imagery training programme.

Mental imagery interventions were found to be effective in reducing cognitive anxiety and somatic anxiety and improving self confidence and attention of volleyball players. It was also effective in improving the performance in serve, pass, attack, and block of volleyball players in actual playing situation.

VanDenberg and Smith, (1993) explored the efficacy of imagery as a means of managing anxiety in high school wrestlers. A treatment group participated in an imagery and relaxation program for nine weeks and was compared to a control group. Both groups were administered the CSAI-2 prior to and following the nine week period. Cognitive and somatic state anxiety intensity decreased significantly for the treatment group, but not the control group. These
findings suggest that imagery combined with relaxation may reduce the intensity of competitive state anxiety.

Jones et al., (2002) explored the impact of kinesthetic imagery on the emotional state and self-efficacy levels of novice climbers. A total of thirty three novice female climbers participated in four sessions of rock climbing techniques. A control group performed additional light exercise, while an experimental group participated in a scripted imagery training program. The imagery comprised both MG-M and MG-content. Climbing performances were similar for both groups, but the imagery group reported significantly lower levels of stress associated with performing correct techniques.

Mellalieu et al., (2009) investigated the efficacy of a motivational general-arousal based imagery strategy in modifying pre competitive symptom interpretations. A staggered multiple baseline single-subject design was employed with five male collegiate rugby union players (M = 24.5; SD = 3.05). The dependent variable was monitored over a full competitive season via measures of pre competitive anxiety and affect together with follow-up social validation procedures. More facilitative interpretations of symptoms associated with competitive anxiety and greater self-confidence levels were reported post intervention, together with changes in positive and negative affect.

Hale and Whitehouse, (1998) attempted to manipulate an athlete's facilitative or debilitative appraisal of competitive anxiety through imagery-based interventions in order to study the effects on subsequent anxiety intensity (heart rate and CSAI-2) and direction (CSAI-2D; Jones and Swain 1992). In a
within-subjects' design, twenty four experienced soccer players were relaxed via progressive relaxation audiotape and then randomly underwent an imagery-based video- and audio-taped manipulation of their appraisal of taking a hypothetical game-winning penalty kick under either a "pressure" or "challenge" appraisal emphasis. There was no significant effect for heart rate. A repeated measures MANOVA for CSAI-2 and CSAI-2D scores revealed that for both intensity and direction scores, the challenge condition produced less cognitive anxiety, less somatic anxiety, and more self-confidence than the pressure situation. This finding suggests that a challenge appraisal manipulation taught by applied sport psychologists might benefit athletes' performance.

Ramsey et al., (2008) explored the conceptualization of debilitative imagery and measured the effects on sports performance (golf putting). Seventy five participants were randomly allocated to one of three conditions: (a) facilitative imagery, (b) suppressive imagery (debilitative), or (c) no-imagery control. After performing imagery, the facilitative imagery group successfully putted significantly more golf balls than the suppressive imagery group. This finding suggests that a non-persuasive conceptualization of debilitative imagery can result in disparate effects on performance compared to facilitative imagery. In doing so, this adds ecological strength to the imagery direction literature by suggesting debilitative imagery need not be persuasive to influence motor skill performance.

Welo (2009) compared the efficacy of two types of mental imagery intervention (cognitive-specific and flow-specific mental imagery) on flow intensity as measured by the Flow State Scale (Jackson and Marsh 1996) and
performance on a timed basketball-shooting task. Eight recreational men basketball ages ranging seventeen to twenty three years formed subjects of the study. Mental imagery interventions of the present study were ineffective in improving shooting performance both reported increases in flow experiences. No significant differences were found between groups.

Bhambri et al., (2005) examining the effect of general relaxation, imagery and combination of both on the mental toughness dimensions of table-tennis players. The study was carried out on thirty two national level table tennis players in the age group of 12-17 years. Loehr psychological performance inventory was administered to assess their mental toughness on self confidence, negative–energy, attentional control, visual and imagery control, motivational level, positive energy and attitude control. The data obtained was analyzed using ANOVA, t test and percentage distribution. The results indicate that all the three psychological interventions enhanced mental toughness dimensions of sports persons. However combined intervention consisting of both relaxation and imagery therapies showed the maximum effect on mental toughness dimensions.

Fletcher and Hanton (2001) examined differences in intensity and direction of competitive state anxiety and self-confidence in hundred and fourteen non-elite, competitive swimmers with varying levels of psychological skills use. They specifically explored usage of relaxation, goal-setting, imagery, and self-talk. Their findings revealed significant differences in the competitive anxiety response between the relaxation, self talk, and imagery groups, but not for goal-setting usage. Calculation of eta-squared revealed that competitive anxiety scores were
influenced primarily by relaxation, followed by self-talk, imagery, and finally goal-setting usage. In other words, swimmers demonstrating high use of relaxation strategies during competition, reported lower intensity and more facilitative interpretations of cognitive and somatic anxiety than those demonstrating low relaxation use.

de la Peña and Derek, (2009) investigated the efficacy of a paradoxical imagery strategy that consisted of participants imaging themselves experiencing symptoms characteristic of competitive anxiety, prior to executing a golf-chip shot among forty male golfers of moderate skill level. Cognitive specific (i.e., skill), motivational general-mastery (i.e., confidence/focus), kinesthetic and positive-outcome imagery were also included in the training programme. Participants showed significant performance improvement in both competitive and pressure situations compared to pre-treatment levels. The findings suggest that paradoxical-success imagery can potentially facilitate performance, when combined with appropriate imagery

de la Peña, et al., (2010) trained twenty seven male club-soccer players with paradoxical-success imagery (de la Peña, 2009) in the field. The subjects showed a positive increase in self-confidence and interpretation of anxiety-related symptoms following training compared to pre-treatment in spite of an initial increase in cognitive anxiety intensity immediately following treatment. Additionally, results suggest that paradoxical success imagery may be best suited for individuals with trait anxiety and the propensity to interpret anxiety-related symptoms as debilitative to performance.
Light (2000) studied the effects of an eight week imagery intervention based on the motivation general arousal element of Paivio's, (1985) analytical framework of imagery effects in modifying perceptions of anxiety from negative to positive, and improving performance of the penalty kick. Using a treatment (imagery) and no treatment (no imagery) design, two male and two female representative youth soccer teams (N = 46) completed a modified version of the Competitive State Anxiety Inventory-2 (CSAI-2D) five minutes before taking five penalty kicks. The CSAI-2D assesses both intensity and direction (debilitative-facilitative) of the state anxiety response. Debilitative state anxiety was assessed using CSAI-2D directional scores. Individuals who scored less than thirty six on cognitive or somatic directional scales were considered debilitative. Following the eight week intervention, participants were again assessed on penalty kick performance. Two-way analysis of variance with repeated measures on the second factor revealed no significant interactions for cognitive anxiety, somatic anxiety; or self-confidence intensity and direction subscales. Main effects were revealed for cognitive anxiety direction and self-confidence intensity.

The analysis was unable to demonstrate performance effects arising from imagery or no imagery exposure. This study indicates that using motivational arousal imagery may not be a compatible treatment for restructuring negative interpretations of state anxiety towards taking soccer penalty kicks.

To summarize progressive relaxation (Jacobson, 1938), autogenic training (Schultz and Luthe, 1959) and breathing exercises are some of the popular somatic techniques in sports anxiety management. Researchers have found imagery
effective in reducing cognitive and somatic anxiety intensity and increasing self confidence. Altering interpretation of anxiety facilitative to performance has been reported using paradoxical imagery. Thus athletic performance could be enhanced by moderating psychological states although equivocal findings have been reported when evaluating the efficacy of various interventions in moderating pre competitive anxiety and mood states.