Chapter III

ANXIETY AND PERFORMANCE
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CHAPTER 3

ANXIETY AND PERFORMANCE – REVIEW OF LITERATURE

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CHAPTER 3

ANXIETY AND PERFORMANCE - REVIEW OF LITERATURE

3.1 Measure of Performance

The experimentalist because of requirements of methodology usually restricts his study of anxiety to the immediate present. He examines a bit of behaviour, i.e. a performance required by design of his experiment. Performance is measured by trials or the time taken or the errors or correct responses made by the subjects in all the trials.

Common type of experiments in learning deals with conditioning, perceptual-motor learning and verbal learning. In most tasks learning, whatever the type may be, is measured in a number of ways: (1) The number of errors in a given trial, (2) The number of correct responses in a given number of trials, (3) The number of trials required to reach perfect performance and (4) The time required to complete the task.

3.2 Motor learning

Motor learning in which the reactions are connected to sensory constituents are basically kinesthetic. The most obvious examples of situations of this kind are those in which the sensory constituents have exclusively kinesthetic origin, i.e. result solely from actual performance of movements in the reaction. Such situations
occur mainly in maze learning with a stylus in which hollow paths are tracked with a stylus held in hand or in the elevated mazes, where the path is tracked with a finger. These can also occur in typing or learning to targets.

In Fitts' work (1954) a logarithmic trade-off was discovered between the duration and spatial precision of rapid aimed limb movements. Fitts' had subjects moving a hand held stylus back and forth between two target regions. The subjects were supposed to hit the targets with high frequency (e.g. making approximately 95% of their movements inside the targets) while minimizing their average movements times. Across different experimental conditions the width (W) of target and distance (D) between target centres were varied systematically.

Motor learning is not different from sensory-motor learning, in both cases the motor or reactive aspect of acquisition is attached to sensory aspect and depends upon it for its actual development. The actual performance of reaction produces this sensory aspect which is in turn controls the movement.

Rather than viewing perceptual-motor behaviour as a series of motor responses, it is better to view such behaviour as an information-processing activity guided by some general plan or programme. Secondly, such behaviour in controlled by feedback. The concept of reinforcement in learning theory is a form of feedback. Thirdly, learning is an adaptive process, the role of experience
is of much importance. Some perceptual-motor tasks are adapted to the probabilities associated with stimulus sequences. As learning continues, overall performance comes to resemble more closely a continuous process.

While discussing the cognitive aspects of skill learning, it should be noted that in the case of perceptual-motor tasks, the cognitive process depends upon task coherence. In highly coherent tasks $S \rightarrow R$ patterns are fixed, on the contrary, a large number of response patterns are involved in less coherent tasks. Anyhow, the learning of perceptual-motor task requires the development and use of many cognitive sets and by this subjects can switch from one to another readily and can include the same $S \rightarrow R$ elements as members of many different cognitive tasks.

Andreas (1972) suggested the taxonomy of perceptual-motor performance. Major categories are as follows:

1) Static motor performance, 2) Discrete motor performance, 3) Simple and choice Reaction time, 4) Positioning reactions. Many other psychologists were also engaged in studying the psychomotor skills. In these, Fleishman's study (1958) is concerned with a class of psycho-motor skills which is probably the important and contains the most numerous and complex kinds of movements. He constructed a number of complex motor tasks namely, Two Hand Co-ordination, Rotary pursuit, Simple dimensional pursuit, Pursuit confusion, Complex co-ordination, Plane control, Motor judgement, Discrimination RT, Visual coincidence, Two hand pursuit, Rate control, Dial betting,
Controls adjustment, Rotary aiming, Reaction time, Track tracing, Steadiness precision, Rudder control, Printed discrimination and Multidimensional pursuit.

3.3 Relationship between anxiety and learning

According to learning theorists drives are hypothetical central states of the organism. Spence's theory of emotionally based drive, states the effect of anxiety (drive) level on performance. The impetus to Spence's work was the development of measure of individual differences in anxiety by Taylor (1952) which is called Taylor Manifest Anxiety Scale (TMAS). Taylor treated anxiety as an important drive and assumed that individual differences in anxiety would be indicative of individual differences in drive level. It was assumed that the individuals who are high anxious tended to be consciously anxious and thus would be higher in drive level in any particular situation. Spence (1964) has surveyed eye-blink conditioning experiments and found that in 21 out of 26 studies, subjects who scored high on MAS showed higher levels of performance. When the unconditioned stimulus is of higher intensity, conditioning occurs more rapidly. In Spence's theory, the magnitude of US (noxious stimulus) determines the level of hypothetical emotional response (Re). The higher the level of (Re) the higher the level of drive. Spence's review of literature seems to indicate that the interpretation of MAS as a measure of drive is supported by eye-blink conditioning experiments.
3.4 Anxiety and verbal learning

In addition to relating MAS to eye-blink conditioning, research has dealt with the relationship between MAS and performance in a variety of other types of complex learning tasks. One such type of task is paired associate learning. Subjects who score high on MAS and who are therefore high in drive should learn the list more rapidly than the subjects who score low on MAS. Because initial habit strength for any $S\rightarrow R$ connection is close to zero and probability of making the correct response to any stimulus is a function of excitatory potential which can be expected to be higher under high drive conditions than low drive conditions, the HA subjects would do well initially than LA subjects. But in the case of complex tasks, the competing responses increase as the task progresses and the HA subjects therefore are unable to build up the necessary 'habit' ($shR$) to evoke correct responses. Hence, the performance of HA subjects is inferior to LA subjects in complex tasks (Spence 1958, Taylor 1958, Taylor-Chappman 1955).

Goulet (1968) considered some other variables influencing performance on these tasks. There are two functionally different learning tasks - response learning and association-learning. Response state involves the learning of each response and the association learning involves hooking up each response to appropriate stimulus (Underwood and Schulz 1966). The analysis involves that Spence's deduction about more incorrect responses would be given to low associative pairs early in learning by high MAS subjects, which does not follow.
Saltz (1970) made an interesting suggestion that HA subjects on MAS are sensitive to failure (i.e. egothreat) whereas LA subjects are sensitive to stress induced by pain. Gawdry and Spielberger (1970) investigated that effects of anxiety and intelligence on paired associate learning using two levels of anxiety and two levels of intelligence. The subjects were required to learn easy paired-associates as needle-thread, table-chair and so on. The words selected were so simple that the same response should be given frequently. Results showed that, early in learning high anxiety facilitated the performance for low IQ subjects relative to their low anxiety counterparts and later in learning high anxiety tended to facilitate the performance for both high and low IQ subjects.

The effects of anxiety on easy tasks have been inconsistent whereas anxiety does have debilitating effect on complex learning, particularly the effects of trait anxiety vary from task to task.

Many experiments have been reported comparing HA and LA subjects in serial learning (Lucas 1952, Montague 1953, Nicholson 1958, Saltz and Hoehn 1957, Deshpande 1972). Willet and Eysenck (1964) have manipulated drive level experimentally, as well as difficulty level in serial rote-learning. They found superior performance under high drive conditions with the easier task, but failed to find the interaction between the two that would be called for by Spence's theory.
Spielberger and Smith (1966) investigated the effects of anxiety on performance in serial rote-learning in two studies in which the learning task consisted of a moderately difficult list of twelve nonsense syllables. On the basis of Spence's Drive Theory it was expected that the performance of HA subjects would be inferior to that of LA subjects in the early stage of learning and superior to the LA subjects in the later stages of learning and the expectancy was of having facilitative effects of anxiety or drive (D) occurring early in the learning for easy words than hard words in the middle. But the predictions failed to get support by the results. The explanation is, since the MAS is a trait anxiety measure, subjects with high scores on the scale would be expected to have higher D than LA subjects only in situations in which they experience failure or threat to self-esteem. Perhaps, there was insufficient stress in the serial learning experiment to cause the subjects to interpret the situation as threatening.

The second experiment was related to IQ. The subjects were led to believe that their intelligence was being evaluated. It was found that the performance of HA subjects was inferior to that of LA subjects early in learning and superior later in learning.

Deshpande (1975) has conducted studies on the relation between anxiety and serial learning. He used nonsense syllables, meaningful words and observed that there was no statistical difference in performance of HA and LA subjects in learning the meaningful words, but LA subjects were better than HA subjects on learning
the nonsense syllables. In the same study, he found that the isolation effects in serial learning were more pronounced for HA subjects than for LA subjects.

Mueller (1976) presented the lists of words; those were phonemically or categorically related and he observed that HA subjects clustered less on both lists and also had lower level of recall. Free recall of HA subjects was less semantically organized than LA subjects.

Purandare (1983) studied the strategies in serial verbal learning. She used HA and LA groups classified on the basis of STAI (Marathi Version) developed by Deshpande and Aljapurkar (1982). She observed that the primacy-finality characteristics remained unaffected by the strategies. The self-pacing strategy which she used, threw more light on the subjects' method of learning the serial lists.

Gupta and Sharma (1987) tested drive theory to incorporate individual differences in intelligence using 120, 9th grade students. A 2 (high-low trait anxiety) x 2 (high-low intelligence) x 2 (ego stress and reassurance) design was used. Findings indicate that the (1) debilitating effects of high anxiety and ego stress on performance of paired associate task of moderate difficulty are nested at the high levels of intelligence, (2) reassurance is most effective in imprinting the performance of high intelligent-high anxious girls and (3) the low-intelligent girls performed poorly, irrespective
of their anxiety levels and stress conditions, Spielberger's prediction for the task of moderate difficulty was not supported.

3.5 Anxiety and Cognitive learning

Generally, psychologists mention three types of learning, e.g. (1) Verbal learning, (2) Motor learning and (3) Problem-solving. But now-a-days a number of more categories have been added as signal learning, cognitive learning, discrimination learning, concept learning etc. The sharp distinction between cognitive and motor processes is often convenient one for practical purposes. There are a number of studies related to cognitive learning. Psychologists are interested in seeing the interactive effects of anxiety and intelligence on it. For most of the researchers, intelligence is regarded as the individual difference variable which is closely related to cognitive task performance.

To explain the individual differences in these tasks, we should take into account the following variables: difficulty of the learning task, stage of learning and the type of performance measure.

In a simple learning task, few error tendencies are evoked. High anxiety would, therefore, be expected to facilitate the performance of all subjects irrespective of their intellectual ability if number of errors or number of trials to criterion is used as the performance measure. However, where the speed of response is used, covert error-tendencies may be detected by this very sensitive measure. Therefore,
it might be expected that high anxiety would impair the performance early in learning for low IQ, and to enhance learning on very easy tasks.

For difficult learning tasks, it would be predicted that the performance of LA subjects would initially be superior to that of HA subjects of comparable ability. As the task becomes easier with repeated practice, high anxiety facilitates the performance of high IQ subjects.

A discrimination reaction time experiment reported by Stabler and Dyal (1963) who used a 'speed of response' measure with subjects who differed in anxiety and intelligence. They found reliable IQ effects but no evidence of an anxiety by intelligence interaction. Their high intelligent subjects were superior over trials, irrespective of their level of anxiety.

Several studies have specifically investigated the relationship between anxiety and complex learning. Mueller (1976) argued that there were at least two different effects that anxiety might have on learning and storage: qualitative and quantitative. Quantitatively, the effects of anxiety on learning have been investigated most thoroughly with the digit span task. For example, Hodges and Spielberger (1969) found that digit-span was negatively related to the level of trait anxiety, whereas Knox and Grippaldi (1970) observed the best digit-span performance in those with moderate
level of trait and state anxiety. Hodges and Durham (1972) obtained an interaction between intelligence and anxiety with high intelligence enhancing digit-span performance for high anxiety subjects, but have a detrimental effect on low anxiety subjects. The evidence suggests that stress and high levels of state anxiety have a detrimental effect on digit-span performance, whereas trait anxiety has negligible effects.

Possible qualitative effects of anxiety on learning were also investigated by Mueller (1976). He linked Easterbrook's (1959) hypothesis with Craik and Lockhart's (1972) depth-of-processing hypothesis and argued that anxious or aroused subjects would utilize fewer of the available attributes while encoding the information. Taking account of Easterbrook's hypothesis, if one assumes that difficult tasks tend to comprise more components or cues than easy ones, then reduced cue under high anxiety would have greater adverse effects on performance of difficult tasks. Anxiety is typically associated with reduced concentration and increased distractibility (Eysenck 1982).

3.6 **Eysenck's Approach**

Eysenck' (1979) uses two main theoretical approaches to explain the results of the experiments:

1. Anxiety disrupts the functioning of working memory.
   
   (Baddley-Hitch 1974) e.g. processing of task information and the transient storage of task relevant information.
2. Individuals, high in trait anxiety, attempt to compensate for the adverse effects of anxiety by increased efforts or investment of processing responses.

As a consequence, they have less spare processing capacity than the individuals low in trait anxiety. He performed (1982) two experiments with 56 undergraduates and the task was letter-transformation, as described by Hamilton, Hockey and Rejman (1977). The task involves transforming between 1 to 4 letters by moving a given distance through alphabet and then producing the result of transformation as the response. The subjects previously completed Trait Scale of STAI. In experiment I, the task was performed in the presence or absence of monetary incentive for superior performance. Adverse effects of anxiety on performance were apparent only on more complex versions of the letter-transformation task. Motivation in the form of monetary incentive improved the performance of low trait anxiety subjects, but had no effect on high trait anxiety subjects. Analysis of the microstructure of the tasks (experiment II) shows that anxiety impaired the rehearsal and storage of the task-relevant information.

These findings strengthen the argument that anxiety reduces the ability to handle concurrent processing demands. They suggest that anxiety reduces the available capacity of working memory.

Keinan, Giora and Zeidner, Moshe (1987) investigated the effects of decisional control on state anxiety and cognitive
performance in a true-to-life evaluative situation. Analyses were based on the mathematics achievement and state anxiety scores of a sample of 74, 8th graders randomly assigned to either decisional choice (DC) or no choice (NC) experimental condition. Subjects in DC condition were given a short mathematics quiz consisting of 5 items and instructed to respond to any three and in NC condition subjects were having no choice. Upon completion of the quiz, subjects were asked to respond to the Hebrew version of STAI. Findings showed that subjects tested under DC conditions were less anxious and attained higher mathematics scores than those tested under NC condition.

In recent years, one personality variable that of test anxiety has attracted much attention (Spielberger, 1972). It is a robust finding that high anxious subjects exhibit performance decrements in relation to low anxious subjects on capacity-demanding tasks that is on the tasks which require subjects to consciously manipulate the information. (Deffenbacher, 1977, 1978, Zatz-Chassin 1983, 1985). Eysenck argued that high anxiety subjects engage in significantly more task-irrelevant responses which are causally responsible for the observed performance decrements than their low-anxiety counterparts.

3.7 Confounding Effects of Intelligence and Anxiety

While studying the effects of intelligence and anxiety on the task of moderate difficulty level, Denny (1968) used the
concept formation task. Subjects were required to deduce the attributes constituting conjunctive concept from information which was given in separate instances. In the experiment low intelligent subjects rarely achieved the worst possible score and high intelligent subjects rarely made the best possible score. High anxiety facilitated the performance of high IQ subjects while impaired the performance of low anxious subjects of comparable ability.

Stating about the relationship between intelligence and anxiety Spielberger writes, 'Materials of average difficulty may actually be quite easy for bright students; the same material may be extremely difficult for less able students or in some cases beyond students' learning capacity. So the task difficulty would seem to depend on both intrinsic complexity of the materials to be learnt and the intellectual ability of the student.'

Gur and Broota (1985) studied the effect of level of anxiety on the processing of stimulus information which varies in dimensionality. It was hypothesized that high anxiety would be detrimental to the efficient processing of complex tasks. 18 post-graduate students, 9 with high and 9 with low scores on anxiety scale were presented with 1 of 3 stimuli, uni-bi-tri dimensional. Dependent variable was Reaction Time. Each subject's time in milliseconds was measured to respond 'same' or 'different' to pairs of stimuli. Results indicate that high anxious subjects on the average were slow in processing the information and also in responding. Low anxiety subjects performed better on bi and tri-dimensional tasks.
Haris, Anne, Hanish and Christine (1987) explored the relationship between arousal level in 120 undergraduates already tested on MAS, and their performance on span of apprehension task. The results showed that the subjects who expressed high levels of trait anxiety were significantly and selectively impaired on the more complex conditions of the task.

3.8 Anxiety and Perceptual-motor Performance

When we examine the effects of anxiety on motor performance, there are a number of conflicting results. An increase in anxiety was associated with increased performance in some studies while the opposite was true in other studies. Taylor (1951) has shown that high anxious subjects were superior in performance while Ausubel, Schiff, Goldman (1953), have reported that low anxious subjects were superior in performance.

Eason-Branks (1963) hypothesized that the relation between arousal and performance depends on the direction of subjects' efforts. To test this hypothesis, they had subjects performing two tasks at once: a pursuit rotor tracking task with a dynamometer and memorization of nonsense syllables. Four conditions of varying incentives were used. (a) low incentive on both verbal and motor task i.e. subjects were told of not being scored on any task. (b) high verbal- low motor (HV-LM) i.e. grade points being given on only verbal task. (c) low verbal-high motor. (d) high verbal-high motor (HV-HM) i.e.
grade points given on both the tasks. Eason-Brank's hypothesis was supported. In HV-LM condition verbal performance was superior and motor performance was inferior to that of LV-LM. The LV-HM condition yielded the opposite pattern of results whereas HV-HM showed verbal performance intermediate to those of HV-LM and LV-LM conditions.

Maternik and Wenger (1970) randomly assigned the subjects to three groups; related arousal, unrelated arousal (URA) and control group. After five trials in pursuit rotor task RA group was told that they would be shocked after any trials in which their performance did not improve over baseline. URA group was told that they would be shocked after certain trials. All three groups were completed ten more trials under stated conditions with no difference in level of performance.

Sage-Bennet (1973) used the Eason-Brank's design in addition with administration of STAI to determine the effectiveness of arousal manipulation. They found RA group was more anxious than the control group; whereas URA group's scores were intermediate. No significant differences were found in subject's pursuit rotor performance.

Motor performance expectancies comprise emotional (e.g. fear or elation), behavioural (e.g. awkwardness or grace) and environmental (loss or gain of status) components in continuous reciprocal interaction (Bandura, 1977). Probably these cognitions include emotionally laden speculations about withdrawal or enhancement.
In motor performance, it is often secondary and tertiary reinforcers which have much impact on individual's meaning system (Meichenbaum-Butler 1980) and so are most likely to produce emotion and concomitant physiological changes that degrade or enhance the performance.

Deffenbacher (1980) concluded that because worry usually correlates with both performance expectations and actual performance measures, it is the source of interference for highly test-anxious subjects. Emotionality plays greater role in motor performance and worry in intellectual performance (Morris-Liebert, 1969).

Kenner-Andrew (1984) investigated a possible relationship between object manipulatory hand movements and attentional demands by observing the frequency of these hand movements in 21, 5th grade children during the performance of three tasks - a monolog, mental arithmetic and rest. The attentional demand of each task was assessed by means of simultaneous RT probe task. Several days after the conclusion of all sessions, each subject completed a general anxiety scale and test anxiety scale. One month later the subjects were administered the Childrens' Embedded Figure Test. The monolog task had both the highest frequency of hand movements and highest level of attentional demand.

Wells-Adrian (1985) explored the hypothesis that when facing a threatening situation, person high in self-consciousness will exhibit high state anxiety. Dispositional self focus would be
positively correlated with trait anxiety and in threatening situation would be associated with increased worry. Women had significantly higher state anxiety scores than men. Significant correlations found for self-consciousness with state-trait anxiety and worry and thus supported the hypothesis.

Mathews, Gerald (1986) tested the effects of trait-state anxiety on intelligence and creativity test performance. Trait-state components of anxiety appeared to affect creativity test performance independently. Intelligence test performance was insensitive to anxiety variables. The anxiety (worry) factor was negatively correlated with creativity test performance but the unique variance of emotionality factor was associated with higher level of performance.

Jain, Swatantar (1986) administered three psychomotor tests to 20 high-anxious and 20 low-anxious subjects. Focus was on determining whether anxiety facilitates or inhibits the performance on psychomotor tasks. Results indicate that high anxious subjects performed significantly poorer than did their low-anxious counterparts on psychomotor tasks.

Perhaps due to physical nature of motor performance, a recognition of its psychological complexity has been slow to develop. But now-a-days, there is growing awareness that factors beyond the merely physiological often limit or enhance motor performance.
Under the pressure of observation or competition many athletes, dancers, musicians experience a debilitating degree of anxiety. The same experience is observed in the case of many high anxious subjects who are performing the task before the audience.

Calvo, Manuel, Almo and Leopoldo (1987) performed two experiments. In experiment I, the attentional demands of two fine (finger movements) and two motor tasks (gross arm movements) were empirically determined using 40 undergraduates. In experiment II, the effects of test condition (stress) and anxiety trait on motor performance were analysed in 20 high trait-anxious and 20 low-trait anxious psychology students. A significant interactive effect appeared. Performance of high-trait-anxious subjects was impaired under the evaluative conditions in fine attentionally demanded tasks but not in gross or simple tasks.

'Psychomotor skill' is a systematic treatment of the variables and explained in S→O→R framework. Some forms of skilled behaviour involve gross bodily activities. de Moja, Carnedo, Reitano, Massimo, Pantaleo (1987) examined one such type of skill in an underwater environment of 24 adults differing in diving experience. STAI was administered to evaluate possible changes in anxiety associated with hyperbaric conditions during the perceptual-motor task. Analysis indicated that in comparison with experienced divers/the unexperienced showed a performance decrement.
Pandey, Roy, Pandey (1988) investigated the effect of frustration on the extent of Muller-Lyer Illusion using 30 high-anxious and 30 low-anxious subjects. Frustration was induced by verbal remarks to subjects who have been classified by scores on MAS. Results showed that frustration enhanced the illusion among high-anxious and reduced in low-anxious subjects.

3.9 Theories of Motor Learning

The scientific study of psycho-motor behaviour did not have a founding father. Many scientists wandered from conventional areas of laboratory investigation and from the studies of everyday world, where motor skills have practical consequences.

Prior to 1960, the field of motor behaviour seemed to be dominated by the task oriented approach (Pew 1974). This approach emphasized 'global' motor learning theories such as that of Hull (1943) and the area was dominated by experimenters who were testing the effects of a large number of independent variables on overall learning and performance of motor tasks.

Since 1960s, motor behaviourists have dealt with kinds of processes occuring as the individual performs and leaves the motor responses. Then onwards, a number of researchers took the lead from Fitt's (1954), concerning the processing of information in skills.
One theory of abilities and learning is proposed about the change in pattern with practice, is a change in manner of performing the task. Taking 'ability' literally as compatibility of doing something, subject would restructure his/her emphasis on various abilities called for by the task to improve or learn and such reorganization has been called work methods (Seashore, 1939, 1940).

Now-a-days, theory about KR (Knowledge of Results) and motor learning became more prominent. Investigators of motor learning were convinced that giving knowledge of results at the end of movement sequence was the way that the skills were learnt. Practice repetitions are usually accompanied with KR and so it is really KR that determines the learning. Bartlett (1948) said it best, 'The common belief that practice makes a man perfect is not true'. It is practice the results of which are known that makes a man perfect.

As old view of motor learning is that the conditions of learning build a habit state and when the habit strength is strong enough, the motor act will occur reliably. KR is a reinforcement event which affects motor learning and it is reasonable to say that KR is determined by habit.

3.9.1 Motor Copy Theory

Perception has been given much attention by psychologists in Russia during the past two decades. The leader in theory construction has been Leontiev; other psychologists especially Zaporozhets, have contributed experiments and theoretical elaboration.
In the process of development, Zaporozhets (1969) said, that gradual changes in the orienting movements occur. He described experiments undertaken in his laboratory to investigate the ontogenesis of orienting movements of the hand and eye with the purpose of demonstrating that copying movements led to formation of an image of an object.

Development of the perception of an object according to Zaporozhets, is an interaction between orienting movements of the hand and the eye. At an early stage of infancy, unconditioned orienting movements of the eye that are imperfect take place. But later the hand reaches the eye by making contact with the object and tracing its contours. As the eye begins to follow, the hand, its orienting movements correspond more and more with the shape of the perceived figure. Later the eye performs the orienting function independently and finally begins to anticipate and direct the orienting function of the hand. Visual perception, in essence, has reduced orienting movement, but it is also formed on the basis of practical activity and only gradually attains relative independence and achieves ideal forms.

3.9.2 Closed-Loop Theory

This system is distinguished from an open-loop system. The closed-loop system has feedback from the response, error detection and error correction, open-loop conceptions of learning have made use of feedback stimuli generated by response, but the use was in behaviouristic tradition of associating stimuli with responses.
The response produced stimuli of one response segment as a way of explaining the learning of movement sequences and serial action (Adams 1968, 1984).

The closed-loop theory of motor learning was published by Adams in 1971. In this theory, Adams conceptualizes motor learning as a problem to be solved and said that KR is the information that the subject was to solve the problem in the post-KR interval. Motor learning is not just strengthening of habit with KR but acquiring capability to detect and correct errors and the growth of such capability is the key word in learning processes.

3.10 Summary of Anxiety related Performance Effects

The experimental work on the effects of anxiety on task performance has produced a number of replicable findings which would need to be accounted for by any adequate theory of anxiety.

1. Anxiety leads to increased task-irrelevant cognitive activities (e.g. worry).
2. Anxiety leads to increased efforts during task performance most of the time.
3. Anxiety reduces digit-span performance (working memory capacity).
4. Anxiety interacts with task difficulty, with adverse effects growing as task difficulty increases.
5. Adverse effects of anxiety are more apparent on subsidiary or incidental task than on main or primary task.

6. Anxiety interacts with type of feedback, with high-anxiety subjects being more detrimentally affected than low-anxiety subjects by failure feedback.

7. High-anxiety subjects are not more detrimentally affected than low anxiety subjects by threat of electric shock; if anything, it is low-anxiety subjects who are more affected by shock.

8. Anxiety induced by failure impairs the retrieval process.

9. There is a closer relationship between state anxiety and performance than there is between trait anxiety and performance.

It has been argued somewhat speculatively that most, if not all, of these findings are predictable from a small set of initial assumptions. First, it is assumed that man has limited processing capacity, and that the worry component of anxiety pre-empts some of the available processing capacity. Secondly, it is assumed that anxious individuals characteristically attempt to compensate for the adverse effects of worry by increased effort expenditure. Thirdly, it is assumed that the aspect of processing capacity most directly involved in mediating the effects of anxiety on information processing is the modality-free central processing component of working memory. This set of assumptions leads to the prediction that anxiety will much more consistently impair processing effectiveness than observed performance efficiency.