

THE INFLUENCE OF ANXIETY ON SEVERAL
MEASURES OF CLASSROOM PERFORMANCE*

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The area of research concerned with the influence of anxiety on human learning and performance has significance for both educational practice and psychological theory. Within an educational context it has particular relevance for procedures used in student evaluation and testing. We live today in a highly test conscious culture. Decisions of major consequence to the individual are increasingly being made on the basis of his performance in tests. It is important, therefore, that the various factors that influence test performance be identified and the nature of their influence determined. There is growing evidence that anxiety is a factor of considerable importance in influencing test performance.

Beyond its relevance for educational measurement, research in this area is also contributing directly to a more precise understanding of human learning and performance. Investigators from quite varied backgrounds have carried out research in this area. Behaviorists (Spence and Spence, 1966), neuro-psychologists (Hebb, 1955; Malmö, 1959) and psychologists adopting a more psychoanalytic position (Sarason et al., 1960) have all developed rival theories designed to explain the influence of anxiety on learning and performance. Within an educational context, Sarason's psychoanalytic position has been found to have greatest relevance.

The influence of anxiety on performance in a variety of laboratory tasks is now quite well documented. Laboratory studies have established that the complexity of the task to be performed and the level of stress (usually defined in terms of level of ego-involvement) inhering in the task are two factors, in particular, which must be considered in explaining the influence of anxiety. Anxiety appears to facilitate performance on simple, straightforward tasks where there is little response competition and to interfere with performance on more complex tasks where response competition is likely (Taylor, 1951; Spence and Taylor, 1951; Taylor and Spence, 1952; Montague, 1953; Standish and Champion, 1960). In conditions where ego-involvement is low, a number of studies have found anxiety to be unrelated to performance (Lucas, 1952; Deese, Lazarus and Keenan, 1953; I.G. Sarason, 1957b; Kalish et al., 1958; Nicholson, 1958; Feshbach and Loeb, 1959), although some studies have found that anxiety facilitated performance (I.G. Sarason, 1956, 1957a; Longnecker, 1962). In conditions of high ego-involvement, anxiety has typically been found to interfere with performance (I.G. Sarason, 1956, 1957a; Nicholson, 1958; Harleston, 1962).

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While these relationships have frequently been demonstrated in relation to laboratory tasks, rather fewer studies have dealt with the question of the relationship between anxiety, task complexity, level of stress, and performance in more naturally occurring situations such as the classroom. Wrightsman (1962), however, in one study, varied level of stress in relation to aptitude test performance. He found no relationship ($r = -.06$) between anxiety and performance in the low ego-involvement condition and a significant negative relationship ($r = -.37$) in the condition of high ego-involvement. While there had been little change in the performance of low anxious (LA) subjects in the two conditions, the performance of high anxious (HA) subjects was reduced by almost one standard deviation by the stress of the instructions.

In a study with college students as subjects, Paul and Eriksen (1964) carried out a similar analysis using a classroom achievement test. A regular psychology class examination was administered on the morning of the experiment (the high stress condition) and a parallel form of the test was administered to the same individuals at night under conditions designed to minimise anxiety (the low stress condition). When their data were analysed using only subjects from the middle range of intelligence, a significant interaction was found between level of stress and level of anxiety. In the high stress condition, LA subjects were superior to HA subjects, while, in the relaxed condition, the HA subjects were superior.

The absence of experimental control over the learning materials and process may be a limiting factor in this study. Wide variation would be expected among the subjects as to the notes and texts used in studying for the examination, as well as for the time spent in studying for the examination.

These difficulties were substantially overcome in a study carried out by Caron (1963). He presented high school students with a 1700 word passage (consisting of an explanation of Atkinson's motive-expectancy-incentive model) to be studied in the experimental situation and, following the study period, obtained measures of rote learning and comprehension. The rote learning questions involved the reproduction of formulae and the definition of symbols contained in the passage, while the comprehension questions required the subjects to apply principles concerning risk preference that were presented in the passage. One half of his subjects studied the passage and were tested under examination conditions while the other half did so under conditions designed to induce curiosity. The condition was established by informing the subjects that the purpose of studying the passage was to enable them to interpret their own personality profiles which had been obtained in a previous testing session. For the rote learning task, there were no differences between HA and LA subjects in either treatment condition. For the comprehension task, there was no difference between HA and LA subjects in the curiosity condition. In the examination condition, however, LA subjects were superior to HA subjects. Caron (1963, p. 537) interpreted these findings as supporting the conclusion ". . . that the performance of anxious subjects on 'simple' tasks does not deteriorate under stress . . . whereas on 'complex' tasks their output suffers markedly."

While Caron's study contains many attractive features, a problem in interpreting some of his results arises because of the shortness of his measuring instruments. Only six rote learning questions and four comprehension questions were used (personal communication) and this may have operated to reduce reliability and, through this, the possibility of obtaining

significant differences between the LA and HA subjects. With respect to the rote learning task, a significant difference in favour of the LA subjects might well have been expected in the examination condition. The subjects were given only fifteen minutes to study the 1700 word passage so that learning that took place might be expected to be rather unstable and unorganized, resulting in considerable response competition in the performance situation. As has already been noted, in these circumstances anxiety may be expected to disrupt performance.

In the present study, the influence of anxiety on the performance of typical classroom tasks was again studied. As in Caron's investigation, the subjects were required to study a prose passage in the experimental situation and were then tested on several performance measures. In the present investigation, the measures obtained were of factual learning and reasoning and by increasing the number of questions asked, an attempt was made to ensure that a satisfactory level of reliability was reached for each measure. On the basis of scores on the High School Form of the Test Anxiety Scale, groups of LA, MA (moderately anxious) and HA high school students were obtained who completed the performance tasks in conditions of either high or low ego-involvement.

Hypotheses

Anxiety is conceived of as a hypothetical construct mediating between certain situational stimuli and various specifiable responses. The stimulus situation which evokes the anxiety reaction is assumed to be such that the individual anticipates a strong threat to his self-esteem. In classroom test situations, the anticipated threat to self-esteem is, most often, failure on the test.

In learning and performance situations, it is the view of Sarason and his colleagues (Mandler and Sarason, 1952; Sarason et al., 1960), that anxiety acts as a cue to elicit both responses that are relevant to the learning or performance task, and responses which are irrelevant. Task-relevant responses are observed in an increase in effort, concentration, and in procedural strategies previously found to facilitate learning and reduce anxiety. Task-irrelevant responses may be observed in the intrusion of thoughts concerning the consequences of failure, of self-deprecating ruminations and by ego-defensive avoidant responses designed to protect the individual from loss of self-esteem. These task-irrelevant responses compete with responses relevant to the task and typically have an interfering effect on learning and performance.

The extent to which interference to performance is caused by anxiety will depend upon level of ego-involvement and task complexity. When ego-involvement is low and performance is not perceived as having important ego-related consequences, little anxiety and few associated task-irrelevant responses will be elicited. In such a situation, therefore, performance for all individuals would be expected to be relatively free of the influence of anxiety. As ego-involvement increases, however, so will the tendency to react with anxiety increase and with this the tendency for interfering task-irrelevant responses to be elicited. When ego-involvement is high, individuals reacting with high levels of anxiety will respond with many more task-irrelevant responses than individuals who react to the same conditions with lower levels of anxiety. When the task is complex requiring concentration and careful processing of information, the intrusion of these task-irrelevant responses would be expected greatly to disrupt performance,

so that level of anxiety would be inversely related to performance.

In the present study, the complexity of both performance tasks was such that anxiety, when elicited, was expected to have a debilitating effect on performance. On the factual learning task, the intrusion of task-irrelevant responses was expected to interfere with both the learning and the recall of the material studied. Because of the limited exposure to the study passage, overlearning would be unlikely so that what was learned would be relatively unstable and unorganized and, as such, highly susceptible to interference resulting from anxiety. Even greater interference was expected on the reasoning task. The presence of task-irrelevant responses was expected to have a particularly disruptive effect on the application of the complex cognitive processes required for performance on this task as generalizations were made, inferences drawn and hypotheses formulated and tested.

On the basis of these considerations two hypotheses were examined:

Hypothesis 1. In low ego-involvement conditions, anxiety has no influence on performance. With both tasks, there will be no difference in the performance of LA, MA and HA groups of subjects.

Hypothesis 2. In high ego-involvement conditions, anxiety acts to disrupt performance in complex tasks. In performing both tasks, LA subjects will be superior to MA subjects and MA subjects will be superior to HA subjects.

Differences in performance for the various anxiety groups were also expected under the two ego-involvement conditions. For the factual learning task, ego-involvement was expected to facilitate the performance of LA and MA subjects. For these subjects the enhancing effects of the increased motivation induced by the high ego-involvement instructions were expected to outweigh any negative effects due to the intrusion of task-irrelevant responses associated with anxiety. Thus it was expected that their performance would be superior in the high ego-involvement condition. For the HA subjects, however, the facilitating effects of the increased motivation were expected to be completely counteracted by the interfering effects of anxiety.

With the more complex reasoning task, the interfering effects of anxiety were expected to be greater than for the factual learning task. Because of this, only the performance of LA subjects was expected to be superior in the high ego-involvement condition. For MA subjects similar levels of performance were expected for the two ego-involvement conditions. For HA subjects the interfering effects of anxiety in the high ego-involvement condition were expected to be substantially greater than any facilitating effects that might occur, so that their performance was predicted to be superior in the low ego-involvement condition.

On the basis of these expectations, two further hypotheses, concerned with difference in performance under the two ego-involvement conditions, were examined.

Hypothesis 3. With the factual learning task, the performance of the LA and MA subjects will be superior when ego-involvement is high. However, HA subjects are expected to perform no better when ego-involvement is high.

ment is high than when it is low.

Hypothesis 4. With the reasoning task, the performance of LA subjects will be superior when ego-involvement is high, the performance of MA subjects will be similar in the two conditions of ego-involvement and the performance of HA subjects will be superior when ego-involvement is low.

Method

The subjects of the study were 173 sixth form male high school students attending three metropolitan boys' high schools in Sydney.

The content of the study passage consisted of a description of life among the Trobriand Islanders of the South Pacific. (1) This content appeared to be particularly suitable, since it was closely related to content typically taught at the high school level and yet there was little chance of the subjects having had any prior experience with it. To control the difficulty level of the vocabulary used in the passage, only words from the Thorndike-Lorge lists (1944) which occur in reading materials with a frequency of six or more times per million words were included. Thorndike and Lorge state that words appearing with this frequency are suitable for use with students in 3rd form and above. The passage contained 1332 words and one illustration, and filled almost six quarto pages of typescript.

Two performance tests were constructed. One measure, the factual learning measure, consisted of 20 multiple-choice questions for which the correct answer was explicitly stated in the study passage. The second measure, the reasoning measure, contained 12 multiple-choice questions for which the correct answer was not explicitly stated in the study passage. In answering these questions the subject was required to make deductions, and to draw inferences and implications from the given information.

Three weeks prior to the test administration, the High School Form of the Test Anxiety Scale (Mandler and Cowen, 1958), specially adapted for Australian conditions, was administered. A split-half reliability coefficient of .86 was obtained for this measure. Subjects scoring in the lower, middle and upper thirds of the anxiety distribution were designated as LA, MA and HA respectively. For each level of anxiety, the subjects were divided into two groups by use of a table of random numbers, one group being allocated randomly to the high ego-involvement condition and the other to the low ego-involvement condition.

To establish conditions of high ego-involvement (2), the subjects were informed that the test was one of scholastic aptitude and that their results would be made available to their headmaster. When the testing was completed, they were informed as to the actual purpose of the test. To establish conditions of low ego-involvement the subjects were informed that

(1) An earlier version of the study passage and performance measures was used in a previous study (Sinclair, 1965).

(2) The administration of the instruments in the high ego-involvement condition was carried out by the author in each school. The administration of the instruments in the low ego-involvement condition was carried out by T. Heys and W.J. Fenley whose assistance is gratefully acknowledged.

the purpose of the test was to establish whether the study passage was a good one for sixth form students or whether the questions were too easy or too difficult.

Twenty-five minutes were allowed for study of the passage. Twenty minutes were provided in which to answer the twenty factual learning questions and a further twenty minutes were provided in which to answer the twelve reasoning questions. These time limits were sufficient to enable all subjects to complete both tests. So that performance on the reasoning measure would not be influenced by the subjects' ability to recall information from the passage necessary for answering the questions asked, they were instructed that they could use the study passage in answering these questions.

Results

The design of the study was a 2 x 3 factorial, involving 2 levels of ego-involvement (high and low) and 3 levels of anxiety (high, moderate and low). This design was used for each of the two performance measures (factual learning and reasoning) with unequal numbers of subjects in each cell.

For the factual learning measure, the means of scores of the different anxiety groups are presented in Table 1. A reliability coefficient (K.R.20) of .59 was obtained for this measure.

TABLE 1
Mean Factual Learning Scores for LA, MA and HA Groups of Subjects in Two Conditions of Ego-involvement

Anxiety Level	Low Ego-involvement			High Ego-involvement		
	N	\bar{X}	sd	N	\bar{X}	sd
LA	28	13.82	2.20	31	16.16	1.81
MA	28	14.32	1.94	29	14.62	2.58
HA	24	13.71	2.74	33	14.03	2.26

TABLE 2
Summary of the Analysis of Variance for the Factual Learning Measure

Source	Sum of Squares	df	Mean Square	F
Ego-involvement	41.73	1	41.73	8.17**
Anxiety	36.02	2	18.01	3.53*
Interaction ..	39.20	2	19.60	3.84*
Error	853.16	167	5.11	

** $p < .01$.

* $p < .05$.

A summary of the results of the analysis of variance carried out on these data (Winer, 1962, pp. 241-244) is presented in Table 2. Both main effects and the interaction were found to be significant. When individual group mean scores were examined by the Newman-Keuls procedure, it was observed that the performance of the LA group in the high ego-involvement condition had largely accounted for the significant results. As predicted, there were no significant differences found between the anxiety groups in the condition of low ego-involvement. In the high ego-involvement condition, as predicted, the performance of the LA subjects was superior to that of MA and HA subjects. The expected significant difference between the MA and HA groups did not emerge. Finally, again as hypothesized, the performance of the LA group in high ego-involvement conditions was superior to that of the LA group in low ego-involvement conditions while for the HA groups performance was similar in these two conditions. The expected superiority of the MA group in the high ego-involvement condition was not found.

TABLE 3

Mean Reasoning Scores for HA, MA and LA Groups of Subjects in Two Conditions of Ego-involvement

Anxiety Level	Low Ego-involvement			High Ego-involvement		
	N	\bar{X}	sd	N	\bar{X}	sd
LA	28	8.00	1.89	31	8.48	2.06
MA	28	7.36	2.08	29	8.38	1.82
HA	24	6.88	2.58	33	7.76	2.05

TABLE 4

Summary of the Analysis of Variance for the Reasoning Measure

	Sum of Squares	df	Mean Square	F
Ego-involvement	27.16	1	27.16	6.28*
Anxiety	24.77	2	12.39	2.87
Interaction	2.23	2	1.11	-
Error	721.68	167	4.32	-

* $p < .05$.

In sum, the hypothesized relationships for the LA and HA groups in the two conditions of ego-involvement were all confirmed. Those for the MA group were not confirmed, the performance of that group being no different from that of the HA group.

For the reasoning measure, the mean scores of the different anxiety groups are presented in Table 3. A reliability coefficient (K.R.20) of .68 was obtained for this measure.

A summary of the results of the analysis of variance carried out on these data is presented in Table 4. In this analysis only the mean square for level of ego-involvement was significant, indicating a general superiority in the high ego-involvement conditions. When pairs of means were analysed, again using the Newman-Keuls procedure, it was found that there were no differences between the anxiety groups in either ego-involvement condition. This was predicted for the low ego-involvement condition but for the high ego-involvement condition an inverse relationship between level of anxiety and performance had been predicted. All anxiety groups performed better in the high ego-involvement condition (although in no case did the difference reach an acceptable level of significance). This was predicted for the LA subjects but not for the MA and HA groups. In fact, for HA subjects superior performance had been predicted for the low ego-involvement condition.

Discussion

With respect to the factual learning task, the results obtained confirmed, in large measure, the hypotheses that were developed for testing. In test-like conditions, anxiety was observed to debilitate performance on that task. With respect to the reasoning task, however, few predicted relationships were supported. Despite the complexity of the task, anxiety did not appear to influence performance in the test-like condition. A possible reason for this latter result is to be found in the manner in which the reasoning test was administered. So that all subjects would have approximately equal access to the factual information upon which the reasoning items depended, the subjects were allowed to consult the study passage while answering the questions. This would make the reasoning task rather comparable to an open-book examination in which the student is able to consult certain reference material on answering the question asked. This procedure, by providing a memory-support (Sieber, 1969) in the performance situation, may well have had a reassuring, anxiety-reducing effect on the HA subjects so that interference to performance due to anxiety may have been minimal.

The results obtained provide a number of conclusions that bear directly on classroom practice and on the different theories that have been developed to explain the influence of anxiety on learning and performance. With respect to the factual learning task, the results support the conclusion that anxiety operates to debilitate performance when a complex task is to be performed in test-like conditions. This conclusion suggests that in important examinations, the HA student will be at a considerable disadvantage. When competing with other students for scholarships, university entrance, school prizes, employment opportunities or simply place in class, anxiety will act to interfere with and reduce the level of his performance.

The results also support the conclusion that while instructions designed to increase level of ego-involvement will raise the level of performance of LA students, it will not do so for MA and HA students. Sarason's theory suggests that for the MA and HA student, the positive motivational benefits deriving from the ego-involving instructions are cancelled out by the operation of task-irrelevant responses which are also

elicited.

This conclusion suggests that the widely adopted practice in education of attempting to motivate students by placing strong emphasis upon the importance of examinations and the need to do well and avoid failure will be of value only to low test anxious students. In the present study with respect to the performance of moderately and high test anxious students on the factual learning task, little was achieved by increasing level of ego-involvement and, through this, anxiety. In fact, it may be that this emphasis, from a long term view, will have quite harmful effects. Since, at high levels, anxiety is such an unpleasant and exhausting experience, this emphasis may serve to engender a strong dislike of school which may eventually lead the student to drop out of school prematurely. Some support for this possibility is provided by Spielberger (1962) who observed, in one study, that HA college students had a higher drop out rate than LA students of comparable ability.

In addition to the implications provided for education practice, the results of the present study also provide implications for theory. The conclusion that in a test-like situation, anxiety will interfere with performance on a complex task is, as we have seen, consistent with the viewpoint of Sarason and his colleagues (Mandler and Sarason, 1952; Sarason et al., 1960). It is also, however, consistent with the Spence-Taylor theory, although in this theory it is the drive function of anxiety that is emphasised rather than the cue function. Spence and Taylor (Spence and Spence, 1966), conceive of anxiety as a drive which combines multiplicatively with the habit strengths of responses present in the individual's response hierarchy. When the desired response is not clearly dominant in the response hierarchy, as tends to be the case in complex performance situations, increase in drive (anxiety) serves to heighten competition among potential responses and in so doing disrupts performance.

The conclusion reached that increase in level of ego-involvement (stress) serves to raise the performance of LA individuals but not MA and HA individuals is, again, consistent with Sarason's theory. This conclusion, however, is not easily accounted for by the Spence-Taylor theory. Although, in the most recent statement of their position (Spence and Spence, 1966), they give passing reference to the question of situational factors (such as ego-involving instructions) that serve to elicit anxiety, they have not considered this question in detail, nor attempted to manipulate such factors in their research studies.

A number of directions for future research are suggested by the results of the present study. In this study the subjects used were male and of above-average ability. There is a need, then, for research to be carried out to determine if the conclusions reached in this study also hold for females and students of average and below-average ability. It is important, too, that ways be found to control the interfering effects of anxiety in the classroom. In particular, ways need to be found by which the HA student may be challenged but his anxiety kept within non-debilitating limits. One suggestion that arises from the present study is the possibility of using open-book examinations where reasoning is the major objective of assessment. Being able to consult appropriate reference material in the examination situation reduces the strain of having to remember and recall large bodies of information and in so doing may serve to reduce anxiety and the interference to reasoning that results. Sieber (1969) in an important recent article, provides further experimental evidence that

the provision of memory supports will be a particular aid to HA students in counteracting the interfering effects of anxiety. In that article she also suggests a number of other ways by which the HA student may be helped to perform more effectively. In particular she discusses the benefits that may be derived from instruction in the use of verbal encoding skills, diagrams, mnemonic devices, notational systems and outlining systems for organizing general ideas prior to the development of detail. There is a need for these suggestions to be followed up in classroom-oriented research.

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