

Emotion, Cognition and Performance in a Stress Context

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Recent research suggests the importance of affect or emotion as a potentially major dependent and/or independent variable in understanding and explaining individual behavior. However, little research has focused on the variation of emotion as a response to the situation or stimulus, nor in terms of cognitive differences that relate to the specific situation. Further, what is the role of individual differences in emotional response? Are some individuals more "emotion prone", especially in a stress situation? The research reported here focuses on the variation of emotion according to the timing surrounding an external stimulus, individual differences, and internal cognitions. More specifically, we investigated emotional response that surrounds a common stress/achievement situation; a student examination.

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I. Theories of Emotion

In recent years, especially, research has focused on the role of affect, mood, and emotion in the context of social information processing. The term *affect* is generally considered to be broad and encompassing. It is a generic term for a wide range of feelings and emotions (Arnold, 1960; Fiske and Taylor, 1984) and is frequently used as an overarching concept that encompasses more specific terms like emotion, mood, and feeling. *Differentiated affect* is aroused by a specific target or situation (Arnold, 1960; Clark and Isen, 1982; Ewert, 1970; Fiske, 1981; Roseman, 1980), and describes an individual's emotional response toward that target or stimulus (Fiske, 1982; Zajonc, 1984). A more intense form of differentiated affect is frequently called *emotion*.

In contrast, *Undifferentiated affect*, or *mood*, has no specific target (Clark and Isen, 1982; Fiske, 1981). It is pervasive and ongoing, for at least some period of time (Bower and Cohen, 1982; Clark and Isen, 1982; Zajonc, 1984).

Affect is potentially important in an achievement oriented situation since it is thought to influence such cognitive processes as learning, memory, and judgment. Smith and Ellsworth (1987:475) state that "Several theorists, ourselves included, believe that an essential function of the emotional response system is to mediate between environmental stimulation and behavioral response." One example is the mood-congruency effect: events that may convey an emotional tone which matches an individual's current mood are attended to most closely and learned best. Further, affect has been related to creativity; a more positive mood is likely to stimulate more creative responses.

Smith and Ellsworth (1987) and others have linked emotion to cognitions, especially appraisal of the situation. They propose that the person constantly engages in a meaning analysis in which the adaptational significance of his or her relationship to the environment is appraised. The outcome of this cognitive evaluation partially determines the person's emotional state. "Accor-

finding to this view, there is a strong relationship between how a person interprets the situation along certain emotionally relevant dimensions and what the person feels" (Smith and Ellsworth; 1987:475).

Most of the social cognition/social affect line of research has concentrated on the effects or consequences of affect. However, a potentially important issue is the variation of affect over time, especially in a stressful achievement context. Also, what is the nature of specific individual, cognitive and situational antecedents of emotion?

II. Research Questions

The specific achievement situation that the present research chose to investigate was a series of student examinations. The research attempted to investigate potential relationships among individual differences, time, cognition, and emotion.

First, the research is interested in whether some specific individual variables would be related to emotion. More specifically, it is expected that past academic performance, self esteem and Type A personality are related to a positive emotion. It is expected that these relationships are stronger in relation to day-to-day emotion, since emotions surrounding an exam would be more likely influenced by the situation.

Q1: Will emotion be related to individual differences?

One research issue is the variation of emotion according to the different circumstances of an external stimulus or situation (for example, in the student examination achievement context).

Q2: How does emotion vary before and after the exam, and after feedback?

It is expected that emotions are generally more negative during the examination situation (when contrasted to day-to-day emotion), and are especially negative immediately before the exam. It is also expected that the negative emotion diminishes as subjects became more experienced with the situation. Repetition is likely to reduce the perceived stress.

Another potentially interesting question is the issue of how cognitions relate to emotion. As suggested by Clark (1982), an unexpected positive event is likely to produce a positive feeling; an unexpected negative event is likely to produce a negative feeling. The difference between expectation and actual performance is likely to influence emotion. That is, emotion is likely to be influenced by whether one is pleasantly-surprised or disappointed.

Q3: Is emotion influenced by a cognitive comparison of actual results to anticipated performance?

The last research question deals with the sequential linkages of cognitions, performance, and emotions throughout the examination process. Figure 1 shows a generic sequential path model that was hypothesized for this research. It is expected that emotion at each stage is mainly influenced by cognitive variables at that stage. Further, the present author expected a chronic emotion effect, reflected by links from emotion at the previous stage, and direct links from baseline emotions. (See later discussion about the appropriateness of path analysis under these conditions.)

Q4: What are the sequential linkages between cognitions and emotions throughout the examination process?

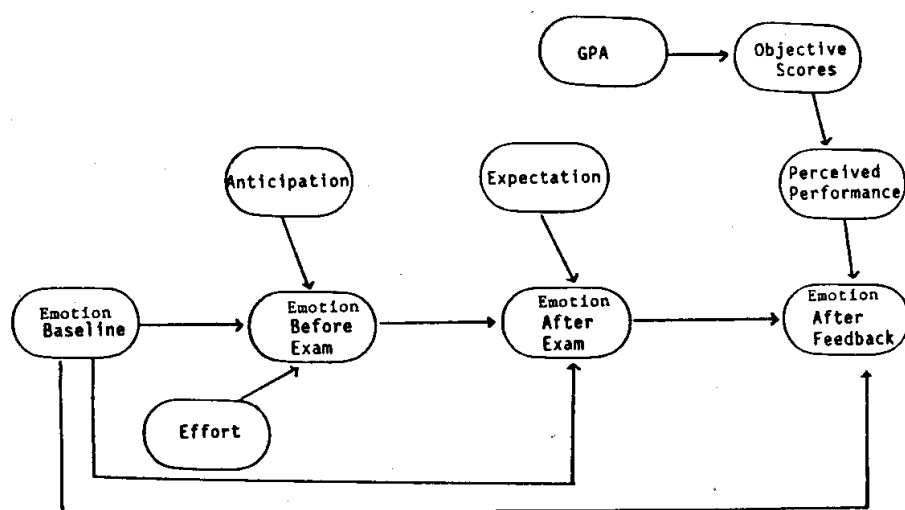


Figure 1. Hypothetical Path Model.

III. Method

1. Subjects and Procedures

The subjects were 119 undergraduate students from four different introductory classes at a major eastern university. Participants for this research received minor extra credit in their course grades for participating, and after completion of this research, they were debriefed with information about objectives and results of the research.

This research was conducted within the context of academic examinations. In essence, the research is a field investigation because the subjects experience genuine life-relevant ongoing emotional experiences. Subjects were asked to respond to questionnaires at several different times (see Fig. 2). At the beginning of the course, subjects were introduced to a brief outline of the research (which would be conducted throughout the semester) and the benefits of their participation. At the first week of the semester, one questionnaire was administered to measure the individual difference variables. For the following three weeks, there were three occasions where emotion was measured in order to provide a baseline emotion of subjects based on their day-to-day life situation. The average score of this measure was used as a baseline stimulus-

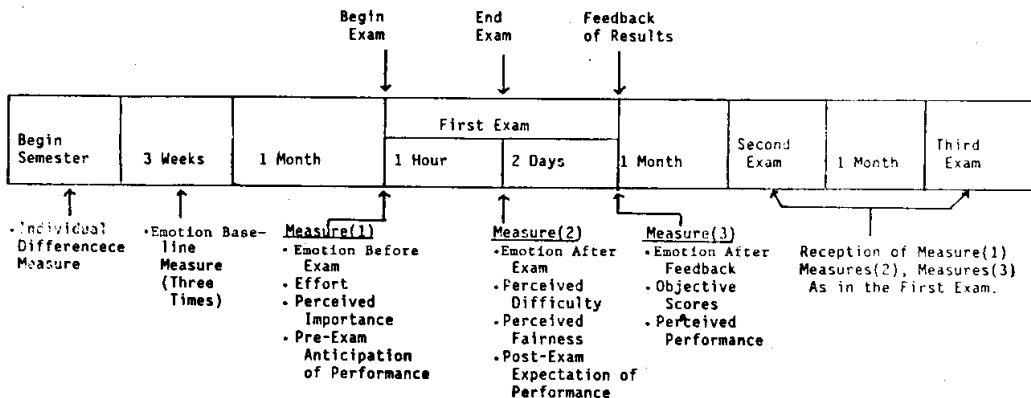


Figure 2. Overall Procedures for Measures.

independent emotion for each subject. Thus, this baseline emotion was not related to the target stimuli (i.e. the examination).

Then later in the semester, three examinations were administered at approximately one month intervals. At each examination, measurements at three timing points were taken: (1) [just before examination] self-reported effort in preparing for that exam, pre-exam anticipation of performance, and emotion before exam, (2) [immediately after examination] post-exam expectation of performance, and emotion after exam, and (3) [later, after receiving feedback for the examination results] objective scores, perceived actual scores, and emotion after feedback.

2. Measures

Measures were collected by questionnaire (with the exception of objective exam scores). The variables are listed in Table 1.

Emotions. The same affect measures were used for both baseline emotion and emotions surrounding the examination experience. Emotion related to the

Table 1. List of Variables

| <i>Variables</i> | <i>Operational Definition</i> |
|--------------------------------|--|
| <i>Emotion Variables:</i> | |
| Baseline Emotion | everyday life emotion state of subjects not related to the target stimuli (i.e., exam). |
| Emotion | emotion state of subjects related to the target stimuli, including <i>anxiety</i> , <i>depression</i> , and <i>hostility</i> . |
| <i>Cognitive Variables:</i> | |
| Anticipation | pre-exam anticipation of performance before the exam. |
| Effort | the self-reported efforts in preparing for the exam. |
| Expectation | post-exam expectation of performance immediately after the exam. |
| Perceived Fairness | perceived degree of fairness of the exam. |
| Perceived Difficulty | perceived degree of difficulty of the exam. |
| Perceived Performance | perceived performance of the actual exam scores after feedback. |
| <i>Individual Differences:</i> | |
| Self-Esteem | generalized expectancy for task success. |
| Type A | personality type |
| GPA | self-reported grade point average |

examination was measured three times for each exam: immediately before exam, immediately after exam, and (later, usually 2 to 5 days) immediately after feedback. A short form of MAACL (Multiple Affect Adjective CheckList; Zuckerman and Lubin, 1965) was used. Pretty and Seligman (1984) have validated the instrument and demonstrated it to be sensitive to transitory mood states. This MAACL is designed to especially measure negative or bad moods such as anxiety, depression, and hostility. The variable overall emotion is a composite index of all of these three sub-scales. A high score means a high negative emotion state. Thus, in this study, four kinds of emotions were measured: *overall emotion* and three sub-scales, *anxiety*, *depression*, and *hostility*.

Although the original instrument is generally purported to measure "mood," we debated whether to call these measures "mood" or not. The measures themselves are clearly *undifferentiated* affect, since the affect measures are not directed at any specific stimulus, but are more "how do you feel now" type of measures. Yet, clearly, we expected the affect measures to be influenced by the examination process, and we expected the affective response might be intense. We therefore decided to call the affect measures "emotion" rather than "mood". And, we expected these emotions to be an affective response to the particular examination situation.

Cognitive and Performance Variables. Selected cognitive variables were also measured at each examination. Immediately before the examination, we measured (1) pre-exam *anticipation* of the examination results, and (2) the self-reported *effort* in preparing for the examination. Immediately after the examination, we measured post-exam *expectation* of actual performance. Later, after feedback of the results, *perceived actual performance*. All of these cognitive variables were measured by Likert 5-point scales, ranging from "very little" or "not at all" (1), to "very much" or "very strongly" (5).

Since terms like "anticipation" and "expectation" can be easily confused, it is appropriate to reiterate these definitions. Anticipation of performance comes before the examination: "how well I think I'm gonna do". Expectation of

performance comes immediately after the examination: "how well I think I did." Perceived actual performance comes after feedback of the actual score: "how I think I actually did."

In addition, *objective performance*, the actual examination score, was also recorded by the researchers. Later, the difference between pre-exam anticipation and post-feedback perceived actual performance was computed for cognitive comparison.

Individual Differences. Selected individual difference variables were also measured. *Type A* personality was measured through the Jenkins Activity Survey (Jenkins, Zyzanski, and Rosenman, 1971). *Type A* is an overt and observable behavior pattern representing an attempt to assert and maintain control over stressful aspects of the environment (Glass, 1977). The higher score means a stronger *Type A* behavioral pattern. The Estimate of Self-Competence Scale (Motowidlo, 1979, 1981) which measures generalized expectancy for task success, was used to measure *self-esteem*. The higher score means a higher level of self-esteem. We expected *Type A* and high esteem individuals to show more positive emotions. Last, we asked each subject for a self-reported grade point average (*GPA*) as a surrogate measure of their overall academic ability. We expected high *GPA* individuals to show more positive emotion.

IV. Results

1. Individual Differences

The zero-order correlations between emotion and *GPA*, Self-Esteem, and *Type A* (research question 1) are shown in Table 2. The most interesting relationships are between the baseline emotion and the individual difference variables, since these correlations are independent of the stressful examination event. Generally, the direction of the relationships were in the expected direction. That is, positive attributes on the individual differences were asso-

Table 2. Pearson Correlations Between Emotion and I.D. Variables

| I.D. Variables | | GPA | | | Self Esteem | | | Type A | | |
|-----------------|--------------------------|--------|--------|--------|-------------|-------|-------|--------|-------|--------|
| Exam | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Emotion | Baseline Overall Emotion | -.17* | | | -.26** | | | -.15 | | |
| | Anxiety | -.14 | | | -.18* | | | -.09 | | |
| | Depression | -.27** | | | -.26** | | | -.22** | | |
| | Hostility | -.03 | | | -.19* | | | -.06 | | |
| Overall Emotion | Before | -.09 | -.06 | .03 | -.04 | -.03 | -.06 | -.14 | .00 | -.23* |
| | After | -.10 | -.10 | -.19* | -.01 | -.17* | -.12 | -.09 | -.18* | -.29** |
| | After Feedback | -.08 | -.25** | -.37** | -.01 | -.08 | -.19* | -.04 | -.03 | -.15 |
| Anxiety | Before | -.13 | -.05 | .10 | .03 | -.03 | -.08 | -.05 | -.07 | -.14 |
| | After | .02 | -.09 | -.10 | .11 | -.12 | -.01 | .06 | -.19 | -.14 |
| | After Feedback | -.09 | -.11 | -.22** | .00 | -.06 | -.01 | -.06 | .03 | -.14 |
| Depression | Before | -.03 | .03 | -.08 | -.04 | .02 | -.05 | -.17* | .05 | -.27** |
| | After | -.14 | -.12 | -.18* | -.06 | -.18* | -.11 | -.15 | -.16* | -.30** |
| | After Feedback | -.13 | -.27** | -.38** | -.02 | -.06 | -.22* | -.08 | -.03 | -.18* |
| Hostility | Before | -.04 | -.14 | .09 | -.08 | -.09 | .01 | -.04 | -.01 | -.06 |
| | After | -.05 | -.01 | -.16* | -.02 | -.10 | -.17* | -.06 | -.06 | -.23** |
| | After Feedback | .02 | -.18* | -.23** | .01 | -.07 | -.15 | -.05 | -.07 | -.14 |

**p<.01 *p<.05

ciated with a less negative (or more positive) mood. Depression showed the strongest relationships. Those with strong (or positive) attributes of individual difference variables such as high GPA, high self-esteem, and more Type A personality were less depressed. Not surprisingly, individuals who do well and think well of themselves have more positive emotions.

2. Timing Variations in Emotion

The results of research question 2 are shown in Table 3, which shows the means and standard deviations of measures of baseline emotion, and each emotion state according to the different points in the examination context. First, when comparing the emotion states related to the examinations with baseline emotion, subjects generally had more negative emotions under the examination situation. As shown in the table, each emotion state related to

Table 3. Means and Standard Deviations of Emotion¹

| Emotion | Baseline Measure M(SD) | Exam Time of Measure | Exam 1 | Exam 2 | Exam 3 |
|-----------------|---------------------------|-------------------------|---------------|---------------|---------------|
| | | | M(SD) | M(SD) | M(SD) |
| Overall Emotion | 12.62 (4.04) | Before | 18.53(5.02)** | 17.31(5.23)** | 17.94(5.02)** |
| | | After | 15.92(4.89)** | 16.27(5.03)** | 17.97(5.93)** |
| | | After Feedback | 15.58(5.50)** | 16.06(5.87)** | 16.34(5.56)** |
| Anxiety | 1.25 (1.11) | Before | 3.64(2.20)** | 2.92(2.39)** | 3.11(2.44)** |
| | | After | 1.42(1.54) | 1.71(1.82)* | 1.99(2.01)* |
| | | After Feedback | 1.21(1.29) | 1.22(1.38) | 1.49(1.63) |
| Depression | 4.41 (1.74) | Before | 6.23(2.86) | 5.71(2.67)** | 5.76(2.73)** |
| | | After | 5.85(2.86)** | 5.61(2.78)** | 6.53(3.50)** |
| | | After Feedback | 5.75(3.18)** | 5.91(3.31)** | 6.03(2.09)** |
| Hostility | 6.96 (2.17) | Before | 8.66(1.85)** | 8.68(1.85)** | 9.07(1.17)** |
| | | After | 8.65(1.93)** | 8.95(1.63)** | 9.46(1.79)** |
| | | After Feedback | 8.63(2.37)** | 8.94(2.13)** | 8.82(2.24)** |

1. Each need state was tested individually by paired T-Test with its baseline.

** $p < .01$

* $p < .05$

the examination were significantly different from baseline emotion ($p < .01$; exceptions—anxiety after the first exam, and anxiety after feedback on all three exams).

Furthermore, the negative emotions were different as the timing changed. In general, overall emotion was more negative before the exam, and became less negative after the exam and after feedback ($p < .05$). More specifically, interpreting the subscales, before the exam, subjects were in a highly anxious state, but this negative emotion was lower after the exam and after feedback ($p < .01$). The other emotion sub-variables, depression and hostility, did not show great differences according to the examination situation.

Another interesting result was that the differences of emotion between before-exam and after-exam generally became less pronounced as students became more experienced with exams in these courses. The mean of differences in overall emotion between before-exam and after-exam were: $M = 2.63$ (s.d. = .44) for the first exam, $M = 1.05$ (s.d. = .48) for the second exam, and $M =$

-.05 (s.d.=.51) for the third exam. The difference in anxiety between before-exam and after-exam was $M=2.21$ (s.d.=.21) for the first exam, $M=1.23$ (s.d.=.22) for the second exam, and $M=1.12$ (s.d.=.23) for the third exam. Thus, this result indicated that the variation in emotion between before-exam and after-exam became smaller as the subjects became more experienced with the examination achievement context.

Overall, the analysis to investigate research question 2 stimulated these conclusions: (1) subjects felt more negative in the examination circumstances when compared to baseline emotion, (2) anxiety especially was higher before the examination than after the examination, and (3) this difference in emotion generally became less pronounced as subjects became more experienced with the examinations.

3. Emotion and Surprise/Disappointment

As suggested by research question 3, specific analyses was conducted to investigate the emotion variations according to cognitive comparisons. Table 4 shows the emotions of subjects according to the changes of cognition related to that examination. That is, students now comparing actual performance with pre-exam anticipation. This is the cognitive differences between initial pre-exam *anticipation* (immediately before exam) and post-feedback perception of actual performance. Here, anticipation less than perceived actual performance indicates pleasant *surprise*. That is, "I did better than I thought I would do." Anticipation greater than perceived actual performance indicates *disappointment*. "I did worse than I though I would do."

Overall, subjects had a more negative overall emotion when their actual performance was less than they had anticipated; i.e. emotions reflected their disappointment ($p<.01$). The subscale "depression" especially showed a response to this cognitive comparison. That is, subjects who performed less than they anticipated were more depressed ($p<.01$). (We also did a similar analysis comparing pre-exam anticipation with post-exam expectation and found similar results—emotion was related to surprise or disappointment.)

Table 4. Emotion After Feedback According to Between Anticipation and Perceived Performance¹

| Emotion | Exam | Pleasant Surprise | | Disappointment | |
|-----------------|------|--------------------------|-------------|----------------|----------------|
| | | ANT < PERF ² | ANT = PERF | ANT > PERF | F ⁴ |
| Overall Emotion | 1 | 12.35(4.13) ³ | 14.79(4.37) | 18.74(5.61) | 17.28** |
| | 2 | 12.76(3.27) | 14.08(4.44) | 19.35(6.22) | 19.33** |
| | 3 | 13.45(3.77) | 15.43(4.52) | 18.61(6.07) | 9.44** |
| Anxiety | 1 | .82(1.11) | 1.12(.89) | 1.58(1.57) | 3.53* |
| | 2 | .91(1.16) | .61(.89) | 1.76(1.53) | 7.97** |
| | 3 | 1.14 (.99) | 1.43(2.06) | 1.74(1.69) | 1.24 |
| Depression | 1 | 3.65(1.16) | 5.06(2.68) | 7.93(3.16) | 26.99** |
| | 2 | 3.91(1.55) | 4.84(2.51) | 7.82(3.53) | 21.44** |
| | 3 | 3.93(1.89) | 5.30(2.05) | 7.72(3.21) | 19.61** |
| Hostility | 1 | 7.88(2.51) | 8.61(2.21) | 9.23(2.26) | 3.21* |
| | 2 | 7.94(1.54) | 8.62(2.19) | 9.78(2.13) | 8.86** |
| | 3 | 8.38(1.68) | 8.70(2.01) | 9.15(2.62) | 1.11 |

1. n for each condition per exam.

Exam 1: n=34, 33, 43. Exam 2: n=33, 26, 49. Exam 3: n=39, 23, 46.

2. ANT=Anticipation, PERF=Perceived Performance

3. Mean and Standard Deviation (shown in parentheses)

4. F-test for three conditions

* $p < .05$

** $p < .01$

Overall, these results show that emotion was strongly related to a before-after cognitive comparison. That is, subjects who did better than anticipated (surprise) had a more positive emotional response. Those who did worse than originally anticipated (disappointed) had a more negative emotional response.

4. Emotion, Cognition, and Performance

We also investigated the sequential relationships between emotion and selected cognitive variables (research question 4). Table 5 shows the correlations between emotion and these cognitive variables. Overall, emotion had significant negative correlations with cognitive variables such as pre-exam anticipation, post-exam expectation, and perceived actual performance. This means those who had higher initial anticipation and expectation had more positive emotions.

Table 5. Pearson Correlations Between Emotion and Cognitive/Other Variables

| Variables | Overall Emotion | | | Anxiety | | | Depression | | | Hostility | | |
|------------------------------|-----------------|----------------|--------|---------|----------------|--------|------------|----------------|--------|-----------|----------------|--------|
| | Before | After Feedback | After | Before | After Feedback | After | Before | After Feedback | After | Before | After Feedback | After |
| Perceived Importance | .07 | .01 | -.01 | .16 | .08 | .07 | .00 | -.02 | -.01 | -.01 | -.02 | -.06 |
| | .04 | -.02 | .07 | .02 | .06 | .09 | -.04 | -.04 | -.04 | -.02 | -.06 | .02 |
| | .21* | .17* | .16* | .32** | .13 | .18* | .12 | .12 | .16* | .10 | .18* | .05 |
| Efforts | -.08 | -.15* | -.08 | .20* | .08 | .05 | -.22* | -.21* | -.06 | -.09 | -.15* | -.13 |
| | -.02 | -.17 | -.07 | .07 | -.01 | -.01 | -.04 | -.20* | -.04 | -.09 | -.17* | -.13 |
| | -.03 | -.03 | .00 | .25** | .12 | .04 | -.19* | -.10 | .03 | -.16* | -.05 | -.07 |
| Pre-Exam | -.26** | -.24** | -.08 | -.09 | .06 | .08 | -.31** | -.28** | -.06 | -.14 | -.25** | -.15* |
| Anticipation | -.24** | -.23** | -.16* | -.14 | -.10 | -.03 | -.18* | -.23** | -.15* | -.25* | -.21* | -.19* |
| | -.32** | -.26** | -.10 | -.15** | -.06 | -.04 | -.29** | -.31** | -.08 | -.25** | -.19* | -.10 |
| Perceived Fairness | .00 | -.11 | .05 | -.03 | -.06 | .07 | .00 | -.10 | .05 | .02 | -.09 | .01 |
| | -.07 | -.20* | -.02 | -.08 | -.12 | .01 | -.09 | -.19* | -.06 | .04 | -.16* | .02 |
| | -.03 | -.16* | -.03 | .03 | -.03 | .03 | -.05 | -.18* | .00 | -.06 | -.14 | -.06 |
| Perceived Difficulty | -.14 | -.06 | -.08 | -.21* | -.13 | -.01 | -.09 | -.10 | -.14 | .02 | .09 | .01 |
| | -.19* | -.27** | -.13 | -.23** | -.29** | -.05 | -.16* | -.21* | -.16* | .01 | -.16 | -.08 |
| | -.12 | -.27** | -.01 | -.14 | -.21* | .01 | -.01 | -.20* | -.02 | -.14 | -.24** | -.01 |
| Post-Exam Expectation | -.21* | -.50** | -.20* | -.22* | -.26** | .01 | -.15* | -.52** | -.28** | -.08 | -.29** | -.10 |
| | -.25** | -.45** | -.19* | -.13 | -.22* | -.06 | -.26** | -.47** | -.18* | -.16* | -.34** | -.20* |
| | -.38** | -.64** | -.10 | -.22* | -.34** | -.11 | -.37** | -.67** | -.13 | -.21* | -.41** | .00 |
| Objective Score | -.03 | -.14 | -.49** | .00 | -.04 | -.21* | -.08 | -.24** | -.54** | .04 | .02 | -.32** |
| | -.32* | -.17* | -.46** | -.09 | -.11 | -.25** | -.20 | -.16* | -.46** | -.21* | -.12 | -.37** |
| | -.05 | -.26** | -.42** | .13 | -.12 | -.23** | -.23** | -.30** | -.48** | .04 | -.15* | -.22* |
| Perceived Actual Performance | -.12 | -.18* | -.61** | -.04 | -.05 | -.25** | -.12 | -.23** | -.66** | -.08 | -.07 | -.40** |
| | -.23** | -.23** | -.66** | -.10 | -.19* | -.36** | -.22* | -.21* | -.69** | -.19* | -.12 | -.51** |
| | .07 | -.17* | -.48** | .11 | -.05 | -.20* | -.08 | -.20* | -.60** | .17* | -.10 | -.21* |

1. Top coefficient is first exam, middle is second exam, and bottom is third exam.

* $p < .05$, ** $p < .01$.

The more interesting and informative interpretation of the relationships between these variables, however, is found with the path analysis. Causal relationships among emotion and the cognitive variable are constructed with a hypothetical path model previously shown in Figure 1. To explore these sequential relationships, separate exploratory path analyses were performed within each examination experience. The results of the path analyses of this hypothetical model are shown in Table 6, for all three examinations and for all three emotion sub-variables. In essence, these are the path-analytical results for nine separate models consisting of various combinations of each of the emotion sub-variable and the particular exam (1, 2, or 3).

The path coefficients are the standardized regression coefficients from the

Table 6. Path Coefficients of the Hypothetical Model in Figure 1¹

| Dependent Variables | Independent Variables | Anxiety | | | Emotion Depression | | | Hostility | | |
|------------------------|-----------------------|---------|-------|-------|--------------------|-------|-------|-----------|-------|-------|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Emotion Before Exam | Emotion Baseline | .16 | .16 | .06 | .13 | .05 | .33* | .60* | .14 | .34* |
| | Effort | .33* | .19 | .54* | -.12 | .16 | .01 | -.06 | .00 | -.03 |
| | Pre-Exam Anticipation | -.21* | -.16 | -.45* | -.26* | -.26* | -.28* | .00 | -.30* | -.31* |
| Emotion After Exam | Emotion Baseline | .06 | -.03 | -.01 | .15 | .12 | -.02 | .27* | .25* | .17 |
| | Emotion Before Exam | .35* | .43* | .27* | .46* | .35* | .38* | .52* | .35* | .30* |
| | Post-Exam Expectation | -.22* | -.15 | -.40 | -.41* | -.33* | -.54* | -.21* | -.21* | -.33 |
| Objective Scores | GPA | .43* | .15 | .43* | .43* | .15 | .43* | .43* | .15 | .43* |
| Perceived | | | | | | | | | | |
| Performance | Objective Scores | .81* | .52* | .67* | .81* | .52* | .67* | .81* | .52* | .67* |
| Emotion After Feedback | Emotion Baseline | .36* | .14 | .10 | .06 | .10 | .07 | .30* | .19* | .14 |
| | Emotion After Exam | .11 | .12 | .20* | .21* | .16* | .08 | .22* | .15 | .32* |
| | Perceived Performance | -.24* | -.24* | -.18 | -.65* | -.64* | -.60* | -.40* | -.47* | -.16 |

1. In this table, emotion refers to anxiety, depression, or hostility corresponding to

* $p < .05$

structural regression equations. Our approach generally follows the recommendations of James, Muliak, and Brett (1984). Each of these path models represents what James et. al. (1984) would call an *exploratory* model. According to James et. al., discussion of the results of an exploratory model are permitted, and indeed are useful, provided one is cautionary about the inductive nature of the model. James (personal communication, February, 1986) also calls this "specification analysis." In essence, the model is mainly suggestive of future research, rather than being regarded as a definitive deductive finding.

Overall, the results in Table 6 showed that emotion at each stage tended to be significantly influenced by cognitive variables. Emotion before exam was strongly influenced by pre-exam anticipation; emotion after exam was strongly influence by post-exam expectation, and emotion after feedback was strongly influenced by perceived actual performance. Also, emotion showed a somewhat chronic effect over time; those who showed more positive baseline emotions were generally more positive throughout the exam process.

To reduce the interpretation to a more manageable set, one specific emotion/examination situation was diagrammed as an example. Among emotion sub-

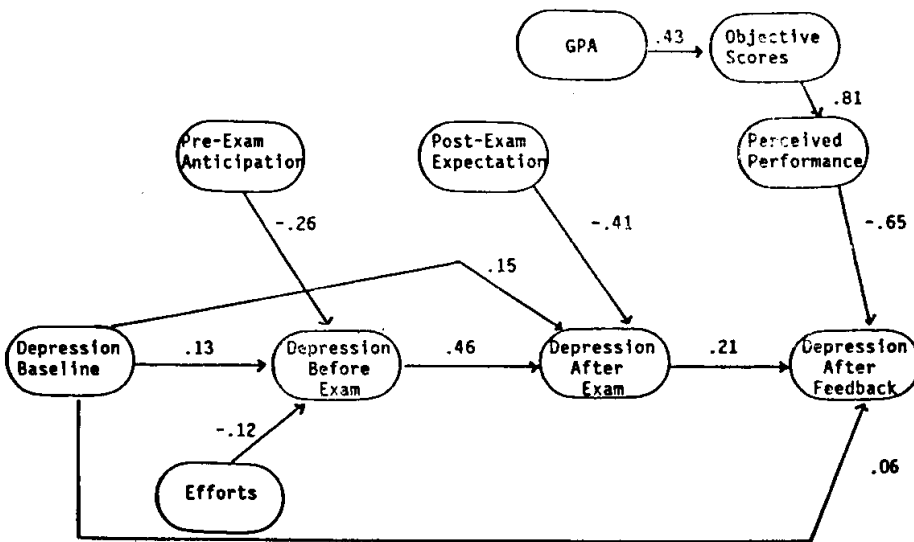


Figure 3. A Path Analysis of Depression.

scales, depression was selected since depression seemed to show the most interesting relationships with cognitive variables. Figure 3 shows the path model derived from the first examination for the depression variable. As shown in this figure, the cognitive variables had strong effect on depression. For example, pre-exam anticipation had a significant negative effect on depression (path coefficient; $p = -.26$). That is, the higher the anticipation of performance, the lower the depression.

Also, post-exam expectation also had a strong negative effect on depression after examination ($p = -.41$). Moreover, the perceived actual performance had a strong negative effect on depression after feedback ($p = -.65$). That is, the higher the individual believed he/she scored, the less depressed he/she was. Also, again, the direct links from depression at the previous stage and baseline depression indicated a modest chronic effect over time.

Thus, the overall results of the path analyses generally supported the hypothetical sequential model among emotion and cognitive variables. Moreover, these results suggested the causal relationship among cognitive and emotion vary longitudinally across the different stages of the examination context.

V. Discussion

The results of this research suggests that emotion varies according to external stimuli as well as internal cognitions. First, students generally have more negative emotions surrounding the examination than day-to-day emotions. Indeed, exams are generally perceived as aversive experiences. Also, students are generally more negative before than after the examination. Among the different sub-scales, anxiety shows the highest variation according to the external stimulus.

Day-to-day emotion was related to individual differences such as self-esteem and Type A personality. In general, positive attributes of the individual were associated with a less negative (or, more positive) emotions, especially less

depression. Further, overall academic performance was correlated with more positive emotions. Day-to-day emotion seemed to have a small but significant carryover into the examination situation.

Emotions were also related to cognitive comparisons. Individuals who performed less well than anticipated had more negative emotions. Those who performed better than anticipated had more positive emotions. Smith and Elsworth (1987) found indications of a similar result with less direct comparisons.

The results of exploratory path analyses showed some sequential relationships among emotions and cognitive variables. In general, emotion was related to concurrent cognitions. Depression, especially, was related to the current cognitive evaluation of how the student performed on the examination.

Overall, the results of our research are quite similar to the findings of Metalsky, Halberstadt, and Abramson (1987), and Smith and Ellsworth (1987). Since their results were reported after the data from this research had been collected, their conclusions did not inspire our design, but are still quite helpful in interpreting our results. Their research concentrated more on the mediating effects of attributions, and clearly showed depression as a result of outcomes they received on a midterm exam. According to Metalsky et.al. (1987), longer term depression was mediated by the attributions made by the students.

While this research has focused on an educational situation as a practical example, the theoretical notions developed here have potential ramification for any stress/achievement situation. For example, in the context of organizationally oriented task such as performance appraisal, we can suggest how emotion might be different according to some of the characteristics of the event; eg. a priori anxiety, more or less depression depending on how the outcome compares with anticipation, more subsequent depression if perceived performance is low. We would also expect smaller, but perhaps still significant influences from individual characteristics such as self-esteem and Type A per-

sonality. While not tested directly, these ideas are generally supported by a qualitative field examination of emotion surrounding performance appraisals, by Longenecker, Gioia, and Sims (1985). They generally found a performance appraisal event to be an extremely aversive and stress inducing situation. Similar to the research reported here, the performance appraisal event has the capacity to evoke quite a negative emotional state. We would also expect to see similar emotional responses in a punishment or reprimand situation.

Overall, this field research has utilized a real situation to investigate how emotion varies under stress. We found stress to induce negative emotions, and these emotions to be significantly influenced by the cognitive evaluations of those experiencing the situation. Further investigations should reveal even more about the nature of both antecedents to and consequences of emotion.

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