The Effects of Varying Degrees of State and Trait Anxiety on Cognitive Task Performance

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Abstract

In order to determine whether children of varying degrees of trait anxiety perform differently in high- and low-stress environments, two types of tasks were administered under two different conditions intended to manipulate subjects' levels of state anxiety. Subjects were coded as either high- or low-anxiety based on their scores on an adapted version of the Revised Children's Manifest Anxiety Scale. Results indicated that subjects performed equally well on digit span tasks in both high- and low-stress conditions, and there was no difference between the performance of high and low trait anxiety subjects. When given block design tasks in the same conditions, subjects performed significantly better in the low-stress condition, although there was no difference between the performance of high and low trait anxiety subjects.
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Theoretical Background

Although the relationship between anxiety and cognitive ability has been a common subject of investigation for well over a century, research has consistently yielded conflicting results and questionable data. Dozens of research groups have conducted similar studies only to discover that they produce opposite findings. For instance, Darke (1988) found that high levels of anxiety impaired performance on cognitive tasks, while Haynes and Gormly (1976) reported that highly anxious subjects had increased recall abilities. In order to account for such contradictory findings, it has been proposed that there are two sources of anxiety, and the specific cause of an individual’s anxiety may be key in determining whether this emotion will impair or enhance cognitive ability.

There are two competing theories regarding the role of anxiety in performance on a cognitive task. The first and likely most popular claims that anxious individuals tend to experience performance decrements, while the second theory argues that a higher level of anxiety may actually improve performance. Each of these claims is supported by various theories that make them appear logical and rational, yet experimental evidence often seems to prove otherwise.

Support for the belief in performance decrements caused by anxiety

Eysenck is one of the primary supporters of the belief that high levels of anxiety impair cognitive ability. He claims that individuals who are highly anxious become distracted by “task-irrelevant processing” (Darke, 1988, p. 145). This worrying limits the resources available to
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devote to the task at hand, thereby reducing working memory capacity in the highly anxious. Low-anxiety individuals, meanwhile, waste fewer resources processing information that is not related to the given task. Consequently, they are better able to concentrate and perform to the best of their abilities (Darke, 1988). In addition, Mueller describes anxiety-related impairment by stating that “high-anxiety subjects can be characterized as encoding fewer semantic features, encoding less elaboratively, and being less flexible in utilizing alternative memory strategies” (1979, p. 288).

This hypothesis has been tested numerous times, and results have been extremely inconsistent. A 1985 study by Eysenck offered support for the hypothesis after testing individuals with extreme anxiety scores. Subjects were 32 undergraduates who were chosen from a larger group based on their exceptionally high and low anxiety scores. Subjects were asked to complete a letter-transformation task involving “transforming between 1 and 4 letters by moving a given distance through the alphabet, and then producing the results of the transformation response” (Eysenck, 1985, pp. 580-581). Results indicated that the highly anxious subjects were significantly slower at completing the task, which Eysenck hypothesized was due to the effect of anxiety on both rehearsal and storage times. In addition, Eysenck found that although subjects with high anxiety experienced impaired performance on every task, this effect was particularly noticeable on the more difficult tasks.

Additional support for the claim that high levels of anxiety result in performance decrements comes from a 1988 study by Darke, in which 32 college undergraduates served as subjects. Based on their scores on the Test Anxiety Scale (TAS), half of the subjects were considered to have high levels of anxiety and half were considered to have low levels of anxiety. Darke conducted two experiments to test working memory capacity in both groups of subjects.
The first experiment employed a digit span test and the second used a linguistic task requiring both processing and storage. Results from the first experiment demonstrated a significant difference between digit spans of high- and low-anxiety subjects, with the latter group scoring substantially higher. Results from the second experiment were also significant, indicating that subjects with low anxiety were better able to both process and store information (Darke, 1988).

Contradictory findings

A 1971 study by Sandison and Burgess produced results contradictory to those provided by Eysenck and Darke. Subjects were initially 78 undergraduate students at the University of Natal, Durban, but 16 high-anxiety and 13 low-anxiety subjects were then selected from this pool. A variation of the digit span test, the Waugh Probe-Digit Technique, was used to measure short-term memory and recall ability in the 29 subjects. Unlike the later studies of Eysenck and Darke, no significant results were found here, suggesting that there is no difference in the recall ability of high- and low-anxiety subjects (Sandison & Burgess, 1971).

A 1984 study by McCann and Meen is particularly relevant to the current research because of its use of secondary school students as subjects. Two-hundred-twenty-two eleventh and twelfth graders served as subjects after completing the Taylor Manifest Anxiety Scale. The experimenters hypothesized that “high anxiety should facilitate the academic achievement of more intelligent students and inhibit the performance of less intelligent students according to the theory of manifest anxiety as drive” (McCann & Meen, 1984, p. 257). Like the Sandison and Burgess study, results of this experiment suggested that there is no correlation between anxiety and academic achievement. According to the researchers, however, their results provide weak
support for the belief that high anxiety enhances achievement in students of high intelligence and impairs achievement in students of lower intelligence.

**Support for the belief in the performance-enhancing effects of anxiety**

Another prominent argument, in direct opposition with that of Eysenck and other researchers, claims that high levels of anxiety provide the stimulation necessary to encourage optimal performance. This claim is supported by Taylor and Spence's drive theory, which, when applied to anxiety, suggests that high levels facilitate performance on simple learning tasks, but impair performance on more difficult tasks. (Heinrich, 1979). Evidence for this theory, however, is even weaker than that for the claim of the impairing effects of anxiety.

A 1992 study by Sorg and Whitney suggested that individuals with high levels of anxiety may outperform their low-anxiety counterparts on cognitive tasks under specific conditions. Subjects in this experiment were 30 college students who had been divided into high and low trait anxiety groups. Each group spent 10 minutes in a non-stressful environment and 10 minutes playing a competitive video game in a stressful, anxiety-provoking condition. After being exposed to each condition, subjects were given a word span and reading span task. Sorg and Whitney found that high trait anxiety subjects outperformed low trait anxiety subjects in the non-stressful condition (Sorg & Whitney, 1992).

Haynes and Gormly (1976) provided somewhat questionable evidence for the theory of the enhancing effects of anxiety when they found that subjects who were judged by their peers as highly anxious had better memory capabilities than their low-anxiety counterparts. The researchers used 13 male university students as subjects. All were members of fraternities, and their fraternity brothers were responsible for determining their general levels of anxiety. Subjects
were given digit span tests and Haynes and Gormly reported that the highly anxious subjects received higher scores. Unfortunately, the experimental method employed in this study appears to be flawed, perhaps enough to discredit the results entirely. For instance, the sample size is quite small for a between-subjects design, so individual differences likely had a substantial impact. In addition, the researchers’ method for assessing subjects’ anxiety is particularly weak, as the information was provided by fraternity brothers and not the subjects themselves. An anxiety scale administered directly to the subjects may have been a more effective means of measurement.

*State-trait distinction*

In addition to establishing which degree of anxiety is most beneficial, researchers have also questioned the role of the source of the anxiety. Cattell and Scheier (1961) proposed the existence of two distinct types of anxiety, each with its own source, causes, and consequences. Trait anxiety is a person’s natural, permanent, and characteristic level of anxiety. It does not rise or fall under varying circumstances, but instead typically remains a static feature of an individual’s personality. State anxiety is quite the opposite— a transitory degree of anxiety largely affected by environmental factors. Whereas trait anxiety generally remains stable over time, state anxiety fluctuates characteristically, often numerous times each day.

The distinction between state and trait anxiety was further examined by Spielberger and colleagues, who conducted several experiments validating the distinction between the them. A study by Gaudry, Vagg, and Spielberger (1975) involving high school and college students as subjects revealed that situational stress directly affected state anxiety but not trait anxiety. This finding suggested that the two forms of anxiety may indeed be separate and unique.
Consequently, the influences of state and trait anxiety on cognitive task performance may vary significantly depending on the source.

Shortly after Spielberger and colleagues conducted their research on the state-trait distinction, Heinrich (1979) attempted to offer additional evidence for the unique effects of each. Based upon previous research suggesting that trait anxiety influences state anxiety, and state anxiety influences academic achievement, Heinrich hypothesized that graduate students of high ability would experience enhanced cognitive task performance with increased state anxiety. Meanwhile, she suggested, students with lower ability levels would experience impaired performance with increased state anxiety. Subjects in the study were 59 graduate students enrolled in an educational research course, and their Graduate Record Examination (GRE) scores were used to measure their academic ability. In addition, three course exams were used as measurements of performance, and the State-Trait Anxiety Inventory was also given to determine subjects’ levels of both variations of anxiety.

Surprisingly, the results of the study offered little support for Heinrich’s hypothesis. Although she found evidence that trait anxiety did influence state anxiety (as previously established by Spielberger, et al.), there was no indication that state anxiety played any role in academic achievement. These findings contradicted Heinrich’s belief that students of high levels of academic ability would perform better on exams when their levels of state anxiety were increased (Heinrich, 1979).

Perhaps the study most relevant to the current research is a 1985 experiment by Leon and Revelle. Subjects were 102 undergraduate students who completed the State-Trait Anxiety Inventory. Subjects were given the task of solving geometric analogies in a relaxed condition and a stressed condition. In the relaxed condition, subjects were given reassurance and unlimited
time. In the stressed condition, subjects were given ego-threatening information when they were told that the test would provide a measurement of their intelligence. Subjects in the stressed condition were also aware of the fact that they were being timed and that their time was limited (Leon & Revelle, 1985).

The results of the Leon and Revelle study indicated that subjects with high levels of anxiety were slower and made more errors in the relaxed condition. No significant results were observed in the stressed condition, as subjects of high anxiety levels were faster but also less accurate. These results suggested that highly anxious individuals experienced performance decrements in low-stress, relaxed conditions (Leon & Revelle, 1985).

Findings differing from those of Leon and Revelle were reported in the previously mentioned Sorg and Whitney study. Unlike Leon and Revelle, Sorg and Whitney (1992) reported that high-anxiety subjects outperformed low-anxiety subjects in the non-stressful condition. The experimenters also noted that the high trait anxiety subjects experienced performance decrements in the stressful condition as compared to the non-stressful condition.

Objectives of the current study

Although there is a wealth of research examining both the effects of anxiety on performance and the state-trait distinction, the previous studies provide little conclusive evidence for any theory. In the words of Darke, “the methodology employed in these [previous] experiments was questionable” (1988, p. 146). Furthermore, the lack of consistent findings among similar studies indicates that investigation into this subject requires a great deal of additional research before any progress is made or conclusive results are uncovered.

Given the lack of reliable data in studies of the effects of state and trait anxiety on
cognitive task performance, there are three objectives to the current research. The first objective is to examine the relationship between state anxiety and cognitive performance for elementary school-aged children of varying degrees of trait anxiety. Specifically, I will attempt to determine how subjects of high and low trait anxiety perform in situations designed to increase or decrease state anxiety through added environmental stress.

The second objective of the current research is to further account for inconsistent data by giving subjects two types of tasks, block design and digit span. It has previously been suggested that performance on abstract reasoning tasks is impaired as anxiety increases, but findings in an experiment employing a digit span test produced the opposite result (Haynes & Gormly, 1976). As a result, I believe that the nature of the task may account for some of the inconsistencies among various studies, and I will attempt to control for this by administering both digit span tests and block design tasks.

The third and final objective is to explore the relationship between anxiety and performance in a population rarely examined in this line of investigation. Because human subjects standards are more stringent for children, there are only a handful of studies examining anxiety in subjects younger than college-aged. I believe that is important to study younger subjects because it is likely that their anxiety levels are more easily manipulated. In addition, I believe that young children may be able to answer an anxiety questionnaire more honestly and with fewer reservations than adult subjects.

Based on findings reported in previous literature, it is difficult to hypothesize about the current study. According to an anxiety-related application of the Yerkes-Dodson law, a moderate level of anxiety should promote optimal performance on the block design and digit span tasks (Halvor, 1994). As a result, it can be hypothesized that the combination of trait and state anxiety
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will be critical in determining how the subjects respond. For instance, a subject with a low level of trait anxiety should perform best on cognitive tasks in the high-stress condition. Conversely, a subject with a high level of trait anxiety should perform best on tasks in the low-stress condition.

Methods

Subjects

Subjects between the ages of 7 and 10 were identified by distributing parental consent letters (see Appendix A) in four classrooms at The Jefferson School in Georgetown, Delaware. Twenty-eight subjects participated, but 3 subjects were not included in the data because of extreme difficulty completing the tasks. In addition, 1 subject was not included in the final sample data for block design due to exceptionally slow times on this task. Consequently, the final sample consisted of 25 subjects, 14 male and 11 female. The average age of subjects was 8 years.

Several weeks before testing, the experimenter spoke to the students in each of the classrooms for several minutes and all interested students were provided with informational consent forms. Students with signed consent forms who were willing to participate were tested by appointment either during recess or after school.

Apparatus

The experiment was conducted at The Jefferson School in a quiet conference room with a large table and four chairs. Three sets of nine blocks were evenly spaced on the table, allowing room for 3 subjects to be tested simultaneously. A sheet of paper and a pencil were provided at each of the three places on the table for the digit span test. The experimenter held the design
cards (three copies of each), and distributed them to the students when needed. The experimenter also held a concealed stopwatch and a clipboard with score sheets for each of the subjects (see Appendix B). In the final phase of the experiment, a basket filled with prizes was presented to the subjects, and a loud, ticking timer was placed on the table before them.

Procedure

Three subjects were tested at each session. When the subjects arrived, the experimenter took several minutes to introduce herself, thank the participants, and explain that participation was voluntary and could be terminated at any time. Subjects were seated at a large table with ample space between one another. Nine blocks were placed in front of each subject, and a few minutes were given to allow subjects to examine and play with the blocks.

To establish a baseline, the 3 subjects completed three block design tasks in which they were given a card and a set of blocks and asked to reproduce the image on the card. The design cards were taken directly from the Wechsler Abbreviated Scale of Intelligence (WASI-III), an intelligence test administered to ages 6 and above. The first design task was of the simplest level, requiring only four blocks. The second was of a moderate level of difficulty, using four blocks but depicting a more complicated pattern. The third design task was the most difficult, requiring all nine blocks. Each task was timed with a silent stopwatch that could not be seen by the subjects in order to prevent increasing their anxiety unnecessarily. In addition, it was ensured that subjects could not see one another in order to prevent competitive anxiety and "copying."

Once the first stage of the block design test was completed, the 3 subjects were asked to complete a brief, modified digit-span test that was administered to the entire group at the same time. In order to make this possible, the task was modified so that subjects wrote the recalled
digits on a blank sheet of paper rather than repeating them aloud. The experimenter recited a 3-digit number string, followed by a 5-digit number string, followed by a 7-digit number string to the subjects. She ensured that subjects did not begin to write until she had finished reciting each of the number strings.

After all subjects had completed the baseline block design tasks and digit span tests, they were reassured that they performed well and were successful. They were each complimented on their abilities and given a short break and a snack (a chocolate chip cookie and juice box). During this break, subjects were permitted to talk amongst themselves and to the experimenter in order to decrease their level of anxiety. After the snack was finished, subjects were told that the next trial was just for fun and they could take as much time as they wanted. Once again, they were given three block design tasks and three digit span tests. Each block design task was timed, but the stopwatch was not visible to the subjects. This stage constituted the low-stress testing condition.

Finally, subjects were tested in a high-stress condition. They were told that the last set of tasks was a contest, and whoever remembered the most numbers and reproduced the block designs fastest would receive a prize. The experimenter then briefly revealed a basket filled with small prizes to the subjects. A loud kitchen timer was placed in front of the subjects so they could see it and hear it ticking at all times. The same procedure of three block design tasks and three digit span tests was repeated, and each subject’s times and number of errors was recorded.

Once the tasks were completed, the experimenter allowed each child to select a prize. She then distributed an adapted version of the Revised Children’s Manifest Anxiety Scale (Reynolds & Richmond, 1978) to each subject (see Appendix C). Intended to measure trait anxiety, the scale consisted of 25 statements and the words “YES” and “NO” to be circled by the subjects.
This scale was developed by psychologists and is highly regarded as a valid and reliable anxiety inventory for children in elementary through high school. In addition, the scale was reviewed by three teachers at The Jefferson School in Georgetown, Delaware. The teachers, all of whom work with 7- to 10-year-olds, were asked for their input in order to ensure that the scale was appropriate for subjects of this age group. The original version of this scale was abbreviated because of time constraints. The experimenter additionally adapted the scale by adding seven pleasant questions that were unrelated to anxiety in order to lessen the intensity and negativity of the scale (e.g., “I love reading”). In addition, three “lie-detected” questions were added to ensure that subjects read the questions carefully and answered honestly (e.g., “I have ten fingers”). The scale was read to younger subjects, while older subjects generally chose to read it themselves. In addition, the experimenter answered any questions the subjects had regarding the scale and provided explanations for any words the subjects found confusing.

At the conclusion of the experiment, subjects were complimented on their performance and thanked for their participation once again. Each subject was then given his or her choice of $10 gift certificates.

The total time required for the entire procedure ranged from 30 minutes to an hour, depending on the speed and talkativeness of each of the groups.

Results

The primary purpose of the current study was to determine whether subjects of varying degrees of trait anxiety perform differently in low-stress and high-stress conditions. Subjects were asked to complete block design and digit span tasks in low-stress and high-stress conditions. Data collected in each of the conditions was used to determine whether there was a
significant difference in performance in the high- and low-stress conditions for subjects of high and low trait anxiety.

The total time each subject required to complete the block design tasks in each condition was recorded in seconds (i.e., lower times indicated better performance). Although subjects were asked to complete three block design tasks, the most difficult task in each condition was eliminated from the final data due to many subjects' extreme difficulty in completing them. As a result, block design times represent the sum of the times required to complete first two tasks in a given condition. Subjects’ performance on the digit span test was coded based on highest level of recall. Subjects received a score of “1” if they could only recall the 3-digit string, a score of “2” if they could recall the 5-digit string, and a score of “3” if they could recall the 7-digit string (i.e., higher scores indicated better performance).

Analysis of the data began by running paired samples t-tests to determine whether, overall, subjects performed differently on the tasks in the high-stress versus low-stress condition. High environmental stress was significantly related to slower performance on the block design tasks, $t(1,23) = -2.800, p < 0.01$, however it had no effect on subject’s performance on the digit span tests, $t(1,24) = -.253, p = .802$. Table 1 displays the means and standard deviations for subjects’ performance on these tasks.
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Table 1

*Descriptive Statistics for High- and Low-Anxiety Groups in High- and Low-Stress Conditions*

<table>
<thead>
<tr>
<th>Task and Condition</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Design, Low-Stress</td>
<td>Low-anxiety</td>
<td>12</td>
<td>58.42</td>
<td>42.07</td>
</tr>
<tr>
<td></td>
<td>High-anxiety</td>
<td>12</td>
<td>83.42</td>
<td>52.81</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>24</td>
<td>70.92</td>
<td>48.41</td>
</tr>
<tr>
<td>Block Design, High-Stress</td>
<td>Low-anxiety</td>
<td>12</td>
<td>99.75</td>
<td>52.59</td>
</tr>
<tr>
<td></td>
<td>High-anxiety</td>
<td>12</td>
<td>145.00</td>
<td>138.14</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>24</td>
<td>122.38</td>
<td>104.80</td>
</tr>
<tr>
<td>Digit Span, Low-Stress</td>
<td>Low-anxiety</td>
<td>13</td>
<td>1.92</td>
<td>.76</td>
</tr>
<tr>
<td></td>
<td>High-anxiety</td>
<td>12</td>
<td>1.75</td>
<td>.76</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>25</td>
<td>1.84</td>
<td>.75</td>
</tr>
<tr>
<td>Digit Span, High-Stress</td>
<td>Low-anxiety</td>
<td>13</td>
<td>2.00</td>
<td>.41</td>
</tr>
<tr>
<td></td>
<td>High-anxiety</td>
<td>12</td>
<td>1.75</td>
<td>.62</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>25</td>
<td>1.88</td>
<td>.53</td>
</tr>
</tbody>
</table>

In order to examine subjects’ levels of anxiety, bivariate correlations were performed to determine whether subjects’ degrees of trait anxiety were related to their performance on the cognitive tasks. As Table 1 suggests, there appears to be a trend in which highly anxious subjects required more time to complete the block design tasks under both the high- and low-stress conditions, and recalled fewer numbers in the digit span tests under both the high- and low-stress conditions. Despite this apparent trend, however, these relationships were not statistically significant (at the $\alpha = .05$ level), although it is important to note that the correlation between subjects’ levels of trait anxiety and block-design performance in the high-stress condition closely approached significance. These correlations are displayed in Table 2.
To further explore whether there might be any relationship between level of anxiety and performance, subjects were dichotomized into high- and low-anxiety groups based on their scores on the Revised Children’s Manifest Anxiety Scale. Each subject initially received a score ranging from 0 to 15, with lower scores indicating low trait anxiety and higher scores indicating high trait anxiety. The mean anxiety score for all subjects was 5.6, with scores ranging from 1 to 13. Subjects with anxiety scores of 4 and below were categorized as low-anxiety, while those with scores of 6 and above were categorized as high-anxiety (there was no score of 5). The mean anxiety score for low-anxiety subjects was 2.2 (N=13). The mean score for high-anxiety subjects was 9.3 (N=12). High and low trait anxiety groups were compared through independent samples t-tests. However, no significant differences were detected between the two groups on either task (block design, low-stress condition, \( t(22) = -1.283, p = .213 \); block design high-stress condition, \( t(23) = -1.060, p = .300 \); digit span low-stress, \( t(23) = .571, p = .573 \); digit span high-stress, \( t(23) = 1.198, p = .243 \)). These results are displayed in Table 1.
Discussion

There is little doubt that children are faced with increasing academic anxiety beginning as early as when they enter elementary school. For many children, the pressures of tests and quizzes, competition with other students, and a growing awareness of their own abilities and shortcomings all combine to develop state anxiety. The primary purpose of the current study was to examine how students of different degrees of trait anxiety are affected by this environmental stress and the state anxiety that results.

The findings of this study indicate that children of all trait anxiety levels perform best on an abstract task (block design) in the low-stress condition. Although this was the only statistically significant finding in the experiment, it is important to note that there were several emerging trends that may have produced significant results had the sample size been larger. For instance, the correlation for anxiety score and performance on the block design task in the high-stress condition was .08, which is approaching significance (this can be observed by comparing the mean time of 83.42 seconds in the low-stress condition with the mean time of 145.00 seconds in the high-stress condition). In addition, the correlation between trait anxiety and speed on the block design task in both the high- and low-stress conditions is positive, while the correlation between trait anxiety and digit span was negative. For the block design task, this indicates that higher times on the block design task were correlated (although not significantly) with higher trait anxiety. On the other hand, greater digit span was correlated (again, not significantly) with lower trait anxiety. This finding indicates that the correlations were moving in the expected directions, although none were significant.

The paired samples t-test of the block design task in high- and low-stress conditions did yield significant results, indicating that subjects of all levels of trait anxiety performed best on
this task in the low-stress environment. These results are in agreement with those of Sorg and Whitney (1992), but contradict those of Leon and Revelle (1985). Because the findings suggest that a low level of state anxiety may enhance performance on visual tasks or those requiring abstract thinking, there are several implications worthy of note.

The first implication of the findings emphasizes the importance of the specific task being performed. It appears as though the nature of the task is critical in determining how environmental or state anxiety will affect performance. The fact that subjects’ scores on digit span remained nearly the same in both conditions but declined in the high-stress condition of the block design task serves as evidence that the type of task is vital in determining the impact of state anxiety.

Perhaps the most important implication of the findings relates to education and the effort to create the best possible learning environment. Based on the significant findings with the high-stress condition and the block design task, it could be suggested that students in anxiety-provoking educational settings may experience impaired performance on certain activities. For instance, a child may require more time to complete a puzzle or similar visually-based task in a classroom with a competitive, stressful, or ego-threatening environment. By developing an awareness of this potential effect, educators will be better able to establish the most ideal setting for optimal student performance.

Because there is very little previous research investigating anxiety and performance in young children, the decision to use this age group in the current study was somewhat novel. As a consequence, several additional limitations were encountered throughout the duration of the study. First, it was observed very early on that some subjects could not complete the block design tasks. This was a surprising discovery since the design cards were taken directly from
WASI-III, which is said to be appropriate for ages 6 and above. This difficulty and constraints on
time made it necessary to eliminate subjects' times on the most difficult designs from the final
data set. An additional difficulty arising from the young age of the subjects was the result of
human subjects standards. Since the subjects were so young, the levels of anxiety and stimulation
they were subjected to had to remain very moderate. I believe that the study would have been
more likely to produce additional results if the high-stress condition had been made somewhat
more anxiety-provoking.

If I were to replicate this study in the future, numerous changes would be made. First, the
three stages (baseline, low-stress, and high-stress) would be separated by a minimum of a few
hours. Ideally, each subject would be tested at three different times to better establish the
distinctions between the high- and low-stress conditions. Because of time constraints, however,
this was impossible, and the sequence of the stages of the experiment was carefully planned in an
attempt to compensate for this. The first stage of tasks was used to establish the baseline because
the environment had not been manipulated in any way intended to increase or decrease anxiety
when subjects first arrived in the room. The second stage was designated as the low-stress
condition because it was anticipated that subjects would relax after completing the first set of
tasks. In addition, it seemed more feasible to increase rather than decrease subjects' anxiety from
stages 2 to 3. For the same reason, the last stage of tasks was designated as the high-stress
condition.

Some of the most significant changes in a future experiment would involve the subject
pool. A smaller age range of slightly older children would prevent the addition of a confounding
variable and likely ensure that almost all subjects would be capable of completing the tasks
without extreme difficulty. I would also like to provide an anxiety questionnaire for parents or
teachers to complete in order to obtain a more thorough assessment of each subject's level of
trait anxiety. Most importantly, however, I would pursue a larger sample in order to increase the
likelihood of producing additional statistically significant findings.

Although there were many limitations to this study, particularly relating to time, I believe
that the significant result obtained for the block design task is useful in establishing a
relationship between state anxiety due to environmental stress and performance on a cognitive
task. The results obtained in this research suggest that children of all trait anxiety levels perform
best on certain tasks with limited stress and stimulation from the environment. Despite the fact
that subjects were told to take as much time as they wanted in the low-stress condition, they
completed the block designs in significantly less time than when they were working as quickly as
possible in order to obtain a prize. Consequently, the notion that subjects' performance on the
block design task was actually inhibited by the anxiety stemming from their desire to win a prize
implies that the use of incentives in the classroom may not always be beneficial. With further
supporting research, this insight might assist in demonstrating the importance of adapting the
level of stress in the educational environment to enable students to perform to the very best of
their abilities.
References


APPENDIX A:

Dear Parents,

As a senior psychology major at Franklin & Marshall College in Lancaster, PA, I will be conducting a project this fall to examine the effects of anxiety on children’s academic performance. I would like to invite your child to be a part of my research. After assessing your child’s ability to remember numbers and copy visual patterns with blocks, I will ask him/her to complete a brief survey about anxiety. The entire session should take no more than a half-hour to forty minutes of your child’s time.

I understand that you may have some reservations about allowing your child to participate in an experiment. I would like to assure you that this study is safe and rewarding, and only a few moments of moderate anxiety may be experienced. Your child may experience a level of anxiety similar to what he/she might feel when competing in a friendly contest with peers. Additionally, please note the anxiety scale being administered was developed by psychologists and has been used for nearly thirty years. The scale has also been reviewed by teachers at a local school to ensure that it is age-appropriate.

The study will be conducted after school and on weekends so that no class time is lost. Please note that involvement is voluntary and all participants and parents have the option of pulling out at any point prior to or during the study. If you have any reservations after you have submitted this consent form, you are free to withdraw your child from the study by notifying me via phone or email. Although you will not be in the room with your child while I am conducting the study, please rest assured that if he or she seems nervous, uncomfortable, or unable to complete the tasks at any time, I will end the session immediately. In addition, your child will receive a $10 gift certificate of his or her choice for helping with my research, even if he/she is not able to complete the session.

I greatly appreciate your consideration in this matter. If you have any questions or concerns or if you would like some more information, please do not hesitate to contact me by phone at (302) 236-6824 or through email at mary.mcmanaman@fandm.edu. Please also feel free to contact my professor and project adviser, Dr. Krista Casler, at (717) 291-3828 or at krista.casler@fandm.edu. Thank you for your time and your help with my study!

Sincerely,
Mary McManaman

If you would like your child to participate, please return this consent form to school by October 23.

I give permission for my child to participate in the study described above. I understand that participation is voluntary and that my child or I may discontinue participation at any time.

Child’s Name: Today’s Date:
Child’s Date of Birth: Contact Phone Number:

Please circle preferred days and times: Friday Monday
Recess 3:15

My child may have a chocolate chip cookie during a short break: YES / NO
If NO, please specify an appropriate snack:
APPENDIX B:

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<tr>
<th>Puzzle</th>
<th>Time:</th>
<th>Number Incorrect:</th>
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<tbody>
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<td>Puzzle 2</td>
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<td>Puzzle 3</td>
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<tr>
<td>Digit Span 1</td>
<td>5 3 7</td>
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<td>Digit Span 2</td>
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<td>Digit Span 9</td>
<td>8 1 5 7 9 3 4</td>
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APPENDIX C:

1. I like spending time with my friends.  Yes / No
2. I have trouble making up my mind.  Yes / No
3. Other kids seem to do things easier than I can.  Yes / No
4. I worry a lot of the time.  Yes / No
5. I enjoy playing outside.  Yes / No
6. I have ten fingers.  Yes / No
7. I am afraid of a lot of things.  Yes / No
8. It is hard for me to get to sleep at night.  Yes / No
9. I like to laugh a lot.  Yes / No
10. I worry about what other people think about me.  Yes / No
11. My hands often feel sweaty.  Yes / No
12. I have a pet dog or cat.  Yes / No
13. I worry about what is going to happen.  Yes / No
14. Other children are happier than I am.  Yes / No
15. I love reading.  Yes / No
16. I have bad dreams.  Yes / No
17. I worry when I go to bed at night.  Yes / No
18. I am more than five years old.  Yes / No
19. It is hard for me to keep my mind on my schoolwork.  Yes / No
20. I wiggle in my seat a lot.  Yes / No
21. I am a very happy person.  Yes / No
22. I am usually nervous.  Yes / No
23. I am wearing shoes today.  Yes / No
24. I often worry about something bad happening to me.  Yes / No
25. Ice cream is one of my favorite foods.  Yes / No