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"I'll Sleep When I'm Dead": Exploring the Relationship between Fatigue, Memory, Feeling, and Mood States among College Students

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Abstract
This study investigated the relationship between sleep and scores on fatigue, with memory, feeling, and mood states. Eighty-two participants completed the Piper Fatigue Scale (Berger et al., 2009), the Semantic Differential Feeling and Mood Scale (Lorr & Wunderlich, 1988), and a memory test (Polzella, 1975). A significant correlation was found between the scores on the Piper Fatigue Scale and scores on the Semantic Differential Feeling and Mood scale, but memory test scores and the Piper Fatigue scale scores were unrelated. The correlation between fatigue, feeling, and mood states indicates that fatigue was negatively correlated with feelings and moods such as depression, anxiousness, fatigue, grouchiness, and uncertainty.

Introduction
“I’ll sleep when I’m dead.” This is a common statement made by many college students today. The trend seems to be that during college sleep is the last thing on a student’s mind. Research has shown that the farther into adolescence you get, the less you tend to sleep (Loessl, B., Valerius, G., Kopasz, M., Hornyak, M., Riemann, D., & Voderholzer, U., 2008). Gaultney (2010) found that college students averaged 6.79 hours of sleep on school nights. This is almost 2 1/4 hours less than the suggested 9 hours of sleep needed to meet psychological needs (Marhefka, 2011). Other research has shown that many college students suffer from some form of a sleep disturbance which decreases the amount of hours they sleep as well (Buboltz, Brown & Soper, 2001). This decrease in amount of sleep per night has many contributing factors making it hard to pinpoint the exact reason or reasons that college students sleep for small amounts of time. Puberty, diminution of parental guidance, the absence of curfews, early class times, jobs, and circadian rhythms are all said to have a unique effect on the sleep-wake patterns of adolescents (Carskadon, 1990). These disruptions in a student’s sleep-wake schedule may result in a significant level of daytime sleepiness which in turn affects multiple aspects of the student’s life.

Furthermore, this lack of sleep results in difficulty in academic settings, which is opposite of what college students need. Chronic loss of sleep has been proven to have wide-ranging effects on brain functioning including distinct effects on multiple components of cognitive processing such as the ability to effectively extract information from stimuli, central processing, and attentional arousal (Ratcliff & Van Dongen, 2009). In an experiment done on exhaustion among college students and the effects exhaustion had on coursework, it was found that there was an inverse relationship between exhaustion and a student’s anticipated GPA (Law, 2007). In addition to this the study done by Law, other studies have found that as chronic sleep loss and daytime sleepiness increase, cognitive difficulties occur leading to a reduction in academic performance and learning (Marhefka, 2011; Ratcliff & Van Dongen, 2009). A unique study by Polzella (1975) also found that one night’s sleep loss proved detrimental to short-term memory; “lapses prevented the encoding of stimuli in short-term memory, which, in turn, prevented their encoding in long-term memory” (199). Lapses, as defined by Polzella (1975), where “involuntary, intermittent periods of lowered reactive capacity that increase in frequency and duration as a function of the degree of wakefulness.” (p. 194). These lapses that occur as a result of wakefulness could have
a direct effect on student’s academic performance. Taken together, the reduction of cognitive processes as a result of exhaustion can be detrimental to college students and their ability to be successful in class. Furthermore, in a study of 44 college students by Pilcher and Walters (1997), performance on a cognitive task was poorer among sleep-deprived students than non-deprived students.

Another effect of sleep loss is its tendency to alter a student’s feeling or mood states. The amount of sleep that someone gets may relate to the overall attitude a person maintains throughout the day. Daytime sleepiness can affect mood and behavior in a negative way and increase the risk for accidents or injury (Marhefka, 2001). Students who tend to fall asleep in class, possibly indicating sleep loss, experience greater negative mood states then those who do not (Jean-Louis, Gizycki, Zizi & Nunes, 1998). Overall, it is said that essentially all forms of sleep deprivation result in increased negative mood states, especially feelings of fatigue, loss of vigor, sleepiness, and confusion (Durmer & Dinges, 2005).

As summarized above, there have been many studies that have tested the effects of sleep loss on cognitive processes. The previous studies have tried to determine what part of the brain is most affected by sleep deprivation and how sleep loss affects memory and central processing. Additionally, studies have been done to test the effect of sleep loss on feeling and mood states. Some interesting conclusions have been drawn by these studies; nevertheless, the current study took a deeper look at the sleep habits of college students and the effects of sleep on cognitive processing and mood. The current study was designed to test the level of fatigue of the participants during data collection. Secondly, the study sought to determine the relationship between the fatigue the participants were experiencing and their ability to complete a memory task. Thirdly, the present study explored the relationship between the fatigue of the participants and their current feeling and mood states.

The following hypotheses were proposed:

1. Scores on the Piper Fatigue Scale (PFS; Berger et al., 2009) would be negatively correlated with the amount of sleep a student reported receiving the night before.

2. Scores on the Piper Fatigue scale (PFS) would be positively correlated with scores on the Semantic Differential Feeling and Mood Scale (SDFMS: Lorr & Wunderlich, 1988).

3. Scores on the PFS would be negatively correlated with scores on individual factors A and B of the Semantic Differential Feeling and Mood Scale (SDFMS) relating to elated or depressed and relaxed or anxious feelings respectively.

4. Scores on the PFS would be positively correlated with scores on individual factors C (confident or unsure), D (energetic or fatigued), and E (good natured or grouchy) of the SDFMS.

5. Higher scores on the PFS would be negatively correlated with scores on a memory test (Polzella, 1975).
Method

Participants

The participants consisted of 82 undergraduate students at a small, private college in the southeast. The study used students from four different classes to complete the instruments and memory test. These classes included a World Civilization II class, an upper level business class, and two Anatomy and Physiology I lab sections.

Participants included 29 males and 53 females. The sample included 41 freshman, 15 sophomores, 19 juniors, and 17 seniors averaging approximately 20 years old in age, $m = 19.8$, s. d. = 1.7.

Instruments

Piper fatigue scale. The 23-item Piper Fatigue Scale (PFS) was used to determine a rating of fatigue for each participant. A revised version of this scale, similar to the one in a study done by Berger, Kuhn, Farr, Lynch, Agrawal, Chamberlain, & Von Essen, (2009), was used for this study. The previous study used a 22-item version of the PFS with the same scoring criteria. The revised PFS has been reported to have an internal consistency reliability of 0.93 - 0.98, as estimated in a study done in adults with cancer (Berger et al., 2009). For the scale used in the present study, the participants were asked to answer questions with the response that best described the fatigue they were experiencing at that point in time. Their response was rated on a scale from 1 to 10 with 1 indicating none and 10 representing a great deal. For example, if the question asked, "to what degree is the fatigue you are feeling now causing you distress?" The participant could answer anywhere on a scale from 1, or no distress, to 10, or a great deal of distress. To get a score for this scale, all scores for all items were added together and divided by 23, or the total number of ratable questions. This provided an overall score for the PFS. Participants who scored 0 were experiencing no fatigue, whereas participants with scores 1-3 were experiencing mild fatigue, 4-6 were experiencing moderate fatigue, and 7-10 were experiencing severe fatigue. There was also one open-ended question included in the instrument that asked: "Overall, what do you believe is most directly contributing to or causing your fatigue?"

Semantic Differential Feeling and Mood Scale. The 35-item Semantic Differential Feeling and Mood Scale (SDFMS) (Lorr & Wunderlich, 1988) measured the feeling and mood states of the participants at the current time in which they participated in the study. The scale took into account the bipolar language of nature and mood and was broken down into five factors. These five factors were labeled A-D and stood for the following: A = elated - depressed, B = relaxed - anxious, C = confident - unsure, D = energetic - fatigued, and E = good natured - grouchy. The SDFMS has fair concurrent validity and fair internal consistency. It has a reliability coefficient of .74 and support from findings on the POMS scales that correspond closely to the SDFMS. The scale contrasts mood states or feelings and the participants checked the box indicating to which mood they were closer. For example, suppose the scale contrasts elated and depressed. The participants would determine which mood they felt best described them and then the participant would place a check mark in the space that describes how they felt. Scoring included totaling the individual scales within the factor and dividing by 7, or the number of items within each factor. Then five scores of each factor were added together to determine the overall score. Each individual score ranged from 1-5 with 1 indicating feelings or mood states closer to
the first word listed above for each factor and 5 represented feelings or mood states closer to the second word listed above. For the overall score, the scores ranged from 1-5 with 1 indicating a positive overall feeling and mood state and 5 indicating an overall negative feeling and mood state.

Memory test. The memory test was a modified version of a test conducted in a study done by Polzella (1975) to determine how human memory was affected by sleep deprivation. In the original study, two types of stimuli made up the experimental material: pairs of letters and pairs of digits. Letter pairs were created from a sample of eight consonants, B, F, H, K, N, Q, V, and X, and digit pairs were created using the digits 2 through 9. This format produced 56 distinct letter stimuli and 56 distinct digit stimuli for their study (Polzella, 1975). A modified version of the memory test was used in the present study. The modified version used the same sample of eight consonants and the same sample of digits 2-9, but the present study only used 24 randomly created letter pairs and 22 randomly created digit pairs. These letter and digit pairs were divided up between a practice trial and 3 scored trials. In the practice trial, 5 of the letter or digit pairs were shown and then one slide contained a question asking whether or not the letter pair or digit pair shown was part of the set of 5. For the first trial, ten letter pairs were used and 5 questions were asked. Then for the second trial 10 digit pairs were used and 5 questions were asked again; and for the third and final trial, 10 letter or digit pairs were used with 5 questions being asked at the end. For simplicity, the test was presented in a PowerPoint format. Scoring on the memory test was determined by counting the number of questions answered correctly. Refer to figure 1 in Appendix B for the practice trial portion of the memory test.

Procedure

All of the instruments listed above were placed in a packet together with a demographics sheet, a memory test answer sheet, and a directions page before the answer sheet to be handed to the participants during data collection.

Data were collected over 4 class periods with professor permission. Instructions were standardized and each student was asked to voluntarily participate. No incentives were given to participate. After the researchers were introduced, the informed consent forms were handed out and the students were instructed to sign them. The participants were told in a summarized version what was on the consent form as well as that their participation in the study was strictly voluntary.

Once the consent forms were signed and returned, the participants were given the packets containing the different scales and the memory test answer sheet. The participants were then instructed to complete the demographics sheet, the PFS, and the SDFMS. Before completion of those surveys, participants were asked to stop when the SDFMS was completed and the participants had reached a page in the packet that instructed them to stop. After completion of the surveys, participants were reminded by the page after the SDFMS to stop and wait for further instruction from the researchers.

The next portion of the data collection was done as one collective group. The memory test was presented to the students as a PowerPoint presentation and the participants were asked to write their answers on the answer sheet in their packet. The memory test began with a practice trial consisting of 5 randomly selected letter pairs
or digit pairs. The directions were presented to the participants, read aloud, and explained thoroughly. Then each letter pair or digit pair was shown for 3 seconds each and after all 5 pairs were shown the participants were given 7 seconds to answer the question at the end of the trial. After the practice trial was complete the 3 main trials of the memory test were executed. The first trial consisted of a set of letter pairs each presented on the screen for 3 seconds with 7 seconds to answer each question. Then, all letter pairs were presented for the second trial with 3 seconds to see each pair and 7 seconds to answer each question. For the last trial both letter and digit pairs were presented, but the participants were still given 3 seconds to see each pair and 7 seconds to answer each question.

After completion of the memory test students were asked to place their packet back on the front page and to turn them in. Once all the data were gathered, the surveys and the memory test were scored as previously described, and the data were analyzed.

Results

To assess the relationship between levels of fatigue, amount of sleep, memory, and feeling and mood states, a Pearson r correlation analysis was performed. The results are summarized in table 1 located in Appendix A.

The first relationship examined was the correlation between scores on the PFS and the amount of sleep the participant had received the night before. It was hypothesized that scores on the PFS would be negatively correlated with the amount of sleep a student reported receiving the night before. It was found that there was an inverse relationship between amount of sleep last night and scores on the PFS (r = -0.195, p = 0.04). This low negative correlation means that as the scores on the PFS went up, the amount of sleep the participant had the night before went down.

Next, the relationship between scores on the SDFMS and scores on the PFS was investigated. The hypothesis stated that scores on the PFS would be positively related with scores on the SDFMS. Analysis of the data showed that there was a significant correlation between the overall scores on the SDFMS and the scores on the PFS, r = 0.506, p < 0.001. The relationship between these two variables was moderately strong and positive. This suggests that the more fatigued a person was the more that their overall mood states were influenced.

It was also hypothesized that scores on the PFS would be negatively correlated with scores on individual factors A and B of the SDFMS. Furthermore, it was expected that scores on the PFS would be positively correlated with scores on individual factors C, D, and E of the SDFMS. Further analysis also showed a significant correlation between the individual factors of the SDFMS and the PFS scale. Factor A of the SDFMS juxtaposed elated and depressed feelings and mood states. The results showed a strong, inverse relationship between scores on the PFS and feelings of elatedness, r = -0.715, p < 0.001. The same can be found true for factor B of the SDFMS. High scores on factor B indicate anxious feelings. There was a moderately strong, negative significant relationship between factor B of the SDFMS and scores on the PFS, r = -0.534, p < 0.001. As fatigued scores increased, relaxed scores deceased. Factor C of the SDFMS measures the degree of unsure feelings or mood states. In analyzing the relationship between Factor C and the PFS scores, a moderately strong,
significant, positive relationship was found between the two variables, $r = 0.615$, $p < 0.001$. As scores on the PFS increased, scores on the individual factor C increased as well, indicating loss of confidence. This same phenomenon is true for the individual factor D which focuses on energy. There was a strong, significant, positive relationship found between scores on the PFS and scores on the individual factor D, $r = 0.845$, $p < 0.001$. This means that as PFS fatigue scores increased, SDFMS fatigue scores increased. High scores on the individual factor E, assess good-natured vs. grouchy feelings. There was a moderately strong, positive relationship between scores on the PFS and scores on individual factor E, $r = 0.564$, $p < 0.001$. As feelings of grouchiness increased, scores on the PFS increased as well.

Finally it was hypothesized that scores on the PFS would be negatively correlated with memory scores. Overall scores on the memory test averaged about 11 out of 15, $M = 10.84$, $SD = 2.06$. This indicates that overall the participants scored very well on the memory test. The results of the Pearson r analysis showed that scores on the PFS and scores on the memory test were unrelated, $r = 0.133$, $p = 0.116$.

Discussion

The significant correlations between the PFS scores and the scores on the overall SDFMS and the individual factors of the SDFMS were supportive of previous research. These findings could also be used in further research as a basis for determining which feeling or mood state is most related to fatigue. In the present study, there was a strong correlation between scores on the PFS and feelings of elatedness and fatigue. There was also a moderate correlation between scores on the PFS and feelings of relaxed, uncertainty, and grouchiness. This seems reasonable considering former research says that a fatigued individual may tend to feel more depressed, anxious, unsure, grouchy, and experience daytime sleepiness (Marhefka, 2011; Jean-Louis, Gizycki, Zizi & Nunes, 1998). The high correlation with fatigue was expected because both scales measured fatigue. Future research could also look into which moods are influenced more by varying amounts of sleep - one night’s sleep loss or chronic sleep loss, for example.

The results supported all but one hypothesis which stated that scores on the PFS would be inversely related with scores on the memory test, but Pearson r results revealed that there was clearly no relationship between the two variables. The nonsignificant correlation could have been the result of a ceiling effect occurring in the study. A pilot study was conducted with the memory test to make sure that it would fit in the testing time and that the difficulty level wasn’t too high. After a small pilot study, the memory test was modified to decrease the difficulty level because it seemed to be too high. The number of stimuli was changed from 15 to 10, but this may have lowered the difficulty level too much. The majority of the participants answered all of the questions correctly on the memory test creating little variability and a resultant ceiling effect. The reduction in variability of the memory test scores may have reduced the correlation between variables, possibly resulting in nonsignificant findings. In future studies, a larger set of pilot studies could be conducted to ensure an appropriate difficulty level of the memory test. Future studies could also use a different task to measure a person’s memory as a cognitive process.

The relationship between amount of sleep last night and scores on the PFS was
significant and would be an interesting topic for further research as well. Scores on the PFS, the amount of sleep last night, and the average amount of sleep the participants received were correlated using a Pearson r correlation analysis. The analysis found that there was a relationship between PFS scores and sleep last night, as mentioned before, but there was no relationship between the average amount of sleep and scores on the PFS. When compared to previous studies the findings of the present study do not agree. Previous research suggests that as sleep loss becomes a chronic condition students will experience greater fatigue and daytime sleepiness (Carskadon, 1990). This conflict between previous research and the current results could also be explained by the design of the PFS. The PFS is a state measure; consequently the relationship between sleep last night and fatigue is more closely related to current state then the relationship between chronic sleep loss and fatigue. As a result of this, it would be interesting to research why sleep last night seemed to have a greater relationship with fatigue than average amount of sleep did.

This study opens the door to several interesting future studies. One significant modification to the study should be made if it is to be performed again in the future. The participants were asked to indicate the amount of sleep that they experienced the night before and on average. In the future, participants could be asked to keep a sleep log for a couple of weeks before the study is conducted. This would allow there to be a more accurate representation of the amount of sleep the participants got the night before and on average. More accurate sleep ratings would increase validity and the ability to detect relationships if they exist. In the present study, the mean amount of sleep was 7 hours with little deviation. Use of a sleep log in future studies would help remedy the problem of little variability found in the current study.

References


### Pearson r Correlation Results

<table>
<thead>
<tr>
<th></th>
<th>PFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLN</td>
<td>r = -0.195, p = 0.039</td>
</tr>
<tr>
<td>SDFMS (overall negative mood)</td>
<td>r = 0.506, p &lt; 0.001</td>
</tr>
<tr>
<td>Factor A (elatedness...depression)</td>
<td>r = -0.715, p &lt; 0.001</td>
</tr>
<tr>
<td>Factor B (relaxed...anxiousness)</td>
<td>r = -0.534, p &lt; 0.001</td>
</tr>
<tr>
<td>Factor C (confident...uncertainty)</td>
<td>r = 0.615, p &lt; 0.001</td>
</tr>
<tr>
<td>Factor D (energetic...fatigue)</td>
<td>r = 0.845, p &lt; 0.001</td>
</tr>
<tr>
<td>Factor E (good-natured...grouchiness)</td>
<td>r = 0.564, p &lt; 0.001</td>
</tr>
<tr>
<td>MT</td>
<td>r = 0.133, p = 0.116</td>
</tr>
</tbody>
</table>

Notes: SLN: sleep last night. SDFMS= Semantic Differential Feeling and Mood Scale. Factors A-E are individual factors of the Semantic Differential Feeling and Mood Scale. MT= Memory Test.
Practice Trial
In this practice trial you will see 5 pairs, some will be digit pairs and some will be letter pairs...

Appendix B

Figure 1

Memory Test Practice Trial

Start

NX

46

92

QB

38

QB

letter pair or digit pair part of the set of 5 you just saw?