Executive Summary

In conducting this study, the researchers hypothesized that students with heavier course loads (i.e. more credit hours per semester) obtain less hours of sleep each night than those with lighter course loads. That being said, students in more math-oriented concentrations (Engineering, Physical Sciences, etc.) would also receive low levels of sleep. This is contrasted by those in Humanities and Social Sciences, who are thought to receive more hours of sleep per night due to a less extensive course load. It was also believed that the reasons for these students’ lack of sleep would be due to extracurricular activities, as compared to those in math-based majors losing sleep due to attending to their studies. While the gender of each subject was recorded, it was not initially thought to have a significant impact on the hours of sleep per night; it was only used to ensure an even sample of the student population. Major findings from the study showed that the majority of the sampled student body had some sort of sleep deprivation, and linked homework to being the foremost cause for this. This research also showed that gender and major had no correlation with sleep.
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Description of Data

The intention of this study is to determine the sleep habits of college undergraduates and the underlying causes that prevent them from receiving an adequate amount of sleep per night. A survey was given over the first week of October, 2009, to a sample size of 257 North Carolina State University students. In this survey, students of all grade levels were questioned on their average sleep patterns during the current semester. The survey retrieved data on gender, main attributed cause of sleep loss, hours of sleep received on average, major, and their rank. The main attributed causes of sleep were defined as homework, going out with friends, watching television, working late, doing stuff on a computer, trouble falling asleep, or other.

In addition to gender and the average amount of sleep of the survey takers, they were also asked about their course of study, grade level, number of credit hours taken this semester, and reason for not obtaining as much sleep as the subject would like. For the last question, students were given seven options to choose from: Doing homework, going out at night with friends, watching TV, spending time on the computer, working late at a job, not being able to fall asleep, or other. A copy of the survey can be found in the appendix.

By conducting this survey during the midpoint of the fall ’09 semester, we hoped to get a general idea of the average number of hours of sleep of the student population, at a time in the semester when class workload was evenly distributed. Also, while the hours of sleep needed per night varied from person to person, eight hours was considered to be the norm of the average adult.

Statistical analysis

Data collected from the surveys was analyzed through the use of the R statistical computing program. Once the data was entered, several plots were made. These included plots of sleep vs. gender, sleep vs. class rank, sleep vs. credit hours per semester, and sleep vs. major. In addition to the plots, summaries were formed for each of the aforementioned plots. These summaries were linear regression models that show the correlation between different aspects of the data. All code used to form summaries can be located in the appendix.
The $R^2$ value of a given set of data is used as a predictor for future outcomes of the experiment, and is something that can be determined from a linear regression model. $R^2$ values for this given set of data proved to be low for all parameters of the data, including sleep based on gender, sleep based on major, and the causes for a lack of sleep.

The above graph displays the weekly hours of sleep per night dependent upon the major of the survey participants. The graph displays an even distribution amongst majors, with engineering having the lowest and highest sleep values. No major achieved an average of higher than seven hours of sleep. The few outliers below five hours were probably due to the several reports of students taking more than twenty hours as a course load. The below summary was generated by a linear regression line of sleep versus major. The low $R$ squared value shows that there isn’t a correlation between sleep and major. This can be attributed to each major having an even course load.

Residuals:

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>1Q</th>
<th>Median</th>
<th>3Q</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.5833</td>
<td>-0.6304</td>
<td>0.2288</td>
<td>0.6271</td>
<td>2.9167</td>
</tr>
</tbody>
</table>
Coefficients:

|          | Estimate | Std. Error | t value | Pr(>|t|) |
|----------|----------|------------|---------|---------|
| (Intercept) | 6.83000  | 0.24187    | 28.238  | <2e-16 *** |
| major2    | -0.24667 | 0.29828    | -0.827  | 0.409   |
| major3    | -0.19957 | 0.30049    | -0.664  | 0.507   |
| major4    | -0.33000 | 0.43756    | -0.754  | 0.451   |
| major5    | -0.45712 | 0.28860    | -1.584  | 0.115   |
| major6    | -0.05881 | 0.28860    | -0.204  | 0.839   |

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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.209 on 242 degrees of freedom
Multiple R-squared: 0.01734,  Adjusted R-squared: -0.002963
F-statistic: 0.8541 on 5 and 242 DF,  p-value: 0.5127

A box plot of sleep based on gender, as well as a summary produced through R, showed that females received more sleep (~0.5 hours per night) on average than males. See figure below and a portion of the fit summary.
Coefficients:

|              | Estimate | Std. Error | t value | Pr(>|t|) |
|--------------|----------|------------|---------|---------|
| (Intercept)  | 6.6604   | 0.0958     | 69.526  | <2e-16 *** |
| gender1      | -0.1463  | 0.1599     | -0.915  | 0.361   |

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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.208 on 246 degrees of freedom

**Multiple R-squared:** 0.003392,  Adjusted R-squared: -0.0006589

F-statistic: 0.8374 on 1 and 246 DF,  p-value: 0.3610

This variation could stem from the fact that more freshman female subjects were surveyed than freshman males. Most of the male subjects were of sophomore rank or higher, indicating that their classes were at a higher difficulty level as opposed to classes at the first year level, thus requiring more time for school work and as a result, less sleep at night. Because of the low R² value there is no correlation between sleep and gender.

On the following page is another summary from R comparing sleep based on class rank. From the summary, it was determined that graduate students were the group that received the most sleep. Despite high outlier values, juniors on average receive an inadequate amount of sleep as compared to the rest of the student body. Sophomores had the largest range from about three to nine hours. The three hour outlier is attributed to the fact that there was a subject taking 23 credit hours this semester. Freshmen received similar amounts of sleep compared to sophomores, but were more condensed around their mean of seven hours of sleep. Seniors had a narrow range of values with an average of seven hours of sleep. This can be attributed to the atypical work loads of seniors, varying between seniors that had major projects in addition to school work to complete, as well as seniors who had few classes to take to meet graduation requirements.
Residuals:

Min  1Q  Median  3Q  Max  
-3.6328 -0.6270  0.1288  0.5778  3.0778

Coefficients:

Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.54592    0.12189  53.705   <2e-16 ***
rank2        0.08689    0.19392   0.448    0.654
rank3        -0.12370    0.21728  -0.569    0.570
rank4        0.32529    0.24285   1.340    0.182
rank5        0.57908    0.44367   1.305    0.193

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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.207 on 243 degrees of freedom

**Multiple R-squared: 0.01775, Adjusted R-squared: 0.001586**

F-statistic: 1.098 on 4 and 243 DF,  p-value: 0.3581
The summary above was generated by a linear regression fit of sleep dependent upon class rank. The extremely low R² value depicts that the variables in question were not significantly correlated. This is mostly likely due to the wide spread of responses generated from the surveys.

The above graph displays the amount of responses to the survey in relation to the attributed cause for a person’s lack of sleep. The graph clearly displays that homework is the most attributed cause of sleep deprivation amongst college students. Surprisingly, the response “going out with friends” received less than forty responses. This would be expected higher as college students are generally associated with partying. The second most blamed reason for lack of sleep is “trouble falling asleep.” This could be a multiple of things like insomnia or loud neighbors.

**Major Findings**

It was concluded from the analysis of the data that there is not a strong correlation between sleep habits and any of the parameters used in the experiment. Unfortunately, for the sake of the study, concentration does not heavily affect the average number of hours of sleep received each night, nor does gender, credit hours taken per semester, or class rank. That being said, the most significant thing found from this study is that the majority of students attribute doing homework to their lack of adequate sleep. This is true for all majors, which disproves the original hypothesis.
Another noteworthy result of the study was that all of the students surveyed were not satisfied with their current sleep pattern. This conclusion stems from the fact that all surveyed listed a response for the last question of the survey: “Which of the following reasons is the main cause of not receiving as much sleep as you’d like?” It is understandable that someone receiving only three hours of sleep per night would have a valid response to this question, though not so much for the rare few that receive nine+ hours of sleep per night.

**Discussion**

One of the major issues we had with our findings is why didn’t any of our variables have a correlation? We believe there should be a correlation between class rank and sleep because seniors generally have senior projects that should be keeping them up, as well as generally having the hardest level classes. We also believe that major should have some affect on sleep, even though our data did not display that. Our research suffered from a multitude of limitations. Firstly, we had too many variables to make any distinguishable correlation. To resolve this one would use a narrower array of subjects, for example focusing solely on students in Engineering and PAMS. In addition, many of our variables were too vague. For instance, we used the term “trouble falling asleep” as one of our causes. This category is clearly too open ended and can encompass a variety of things like noisy neighbors or sleep disorders.

Another limitation our study had was the type of participants. The sample was random and a variety of biases could have been falsely portrayed in the data. The integrity of our participants could have been compromised by an assortment of ways. The participant might have been in a rush and didn’t answer the survey effectively, or the participant could also have sought to intentionally give us wrong information. The time of day and locations we took our survey also biased the results. The Brickyard, while one of the more densely populated areas of NCSU’s campus, biased the results by restricting the types of students that frequent it. Most students that pass through the Brickyard during the mid-morning hours are those in the humanities and social sciences, as well as a higher magnitude of underclassmen. To obtain a more well rounded sample, surveys should have been handed out on Centennial Campus, which has a high population of engineers, the majority of them being upperclassmen and graduate students.
Even if the sample was well rounded, it was still considerably small compared to the size of the NCSU student population, which contains over 30,000 students. Sampling 1/100th of the population just did not provide a sufficient sample for the whole student body.

Appendix

R Code

> mydata=read.table("clipboard", header=T)
> gender=as.factor(mydata$Gender)
> major=as.factor(mydata$Major)
> rank=as.factor(mydata$Rank)
> cause=as.factor(mydata$Cause)
> sleep=mydata$Sleep
> credit=mydata$Credit
> plot(sleep ~ gender)
> plot(sleep~major)
> plot(sleep~rank)
> plot(sleep~cause)
> plot(sleep~credit)
> fit=lm(sleep ~ gender+major+rank+credit+cause)
> summary(fit)
> fit2=lm(sleep~cause)
> summary(fit2)
> fit3=lm(sleep~credit)
> summary(fit3)
> fit4=lm(sleep~gender)
> summary(fit4)
> fit5=lm(sleep~rank)
> summary(fit5)
> fit6=lm(sleep~major)
> summary(fit6)