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The Effects of Sleep on Academic Performance and Job Performance

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THE EFFECTS OF SLEEP ON ACADEMIC PERFORMANCE AND JOB PERFORMANCE

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Introduction

Sleep is very important to a human being's health. Sleep loss not only makes people feel sleepy in the daytime, it is even a possible factor for Alzheimer's disease (Slats, Claassen, Verbeek, & Overeem, 2013). The effects of sleep manifest in both health and performance. The relationships between sleep and performance have been studied in many different fields including human science, medicine, psychology, education, and business. Sleep-related variables (e.g. sleep deficiency, sleep quality, sleep habits) have been shown to influence performance of students and workers (Lack, 1986; Mulgrew et al., 2007; National Sleep Foundation, 2008; Pilcher & Huffcutt, 1996; Rosekind et al., 2010). Therefore, the purpose of this study was to determine the effect of sleep on academic and job performance.

Sleep and Health

The history of sleep research can be traced back to the 19th century (Pelayo & Guilleminault, 2009). According to the National Sleep Foundation's *Sleep in America Poll*, U.S. adults sleep about seven hours every night, a decrease of approximately two hours per night since the 19th century (National Sleep Foundation, 2005). In 2008, the same organization found that Americans expected to average 7 hr 18 min of sleep per night, but they actually only slept an average of 6 hr 40 min (National Sleep Foundation, 2008). A common term for "loss of sleep" is "sleep deprivation." Drummond and McKenna (2009) stated that "sleep deprivation in humans can be broadly classified into three categories: total sleep deprivation, partial sleep deprivation, and sleep fragmentation (p. 249)." In previous studies, sleep deprivation was measured by type: long-term total sleep deprivation (continually awake for more than 45 hours), short-term total sleep deprivation (continually awake for up to 45 hours), and partial sleep deprivation (sleeping less than 5 hours in a 24-hour period) (Pilcher & Huffcutt, 1996).

Rosen et al. (2006) investigated the association between sleep deprivation and mood disturbance, empathy, and burnout among 47 (80% response rate) interns in a medical residency program. The researchers found an increased prevalence of chronic sleep deprivation (9% to 43%), sleepiness (11% to 36%), moderate depression (4.3% to 29.8%), and burnout (4.3% to 55.3%) by the end of the internships. Simpson and Dinges (2007) reviewed a number of comprehensive studies that examined the effects of sleep loss on the human immune system. They found that the levels of important immune-related chemical substances in blood plasma were different at bedtime and wake-up time. These irregular changes in the immune system affected both behavioral functions (e.g., sleepiness, fatigue, and attention lapses) and physiological functions (e.g., inflammation). Lack of sleep has been linked to emotional and physical health effects including depression, burnout, obesity, diabetes mellitus, hypertension, cardiovascular disease, stroke, and even death (Rosen, Gimotty, Shea, & Bellini, 2006; Simpson & Dinges, 2007).

Sleep and Work

Shift work, also defined as working non-standard hours, has been shown to impact sleep and circadian rhythms (Wyatt, 2001). This type of work schedule is common in the hospitality industry (Cleveland et al., 2007). Depending on occupation, studies found a stronger relationship between sleepiness and work limitations for white-collar workers (e.g., hospitality industry workers) as compared to blue-collar workers (e.g., in the manufacturing industry) (Mulgrew et al., 2007). A Study has also found that employees who did not get enough sleep and experienced sleepiness during work hours had the highest percentage of accidents in the workplace and often nodded off during driving indicating work safety issues (Rosekind et al., 2010). In the student population, Trockel, Barnes, and Egget (2000) found that students who worked more hours had lower GPAs than students working fewer hours. As of yet, no known studies have been conducted to examine the relationships between sleep, work hours, and workplace accidents in the hospitality management field.

Sleep and College

Weitzman et al. (1981) defined Delayed Sleep Phase Syndrome (DSPS) as follows: 1) long sleep latency on weekdays (usually fall sleep between 2 a.m. to 6 a.m.); 2) normal sleep length on weekends (usually sleep late and wake up late on weekends); and 3) difficulty staying asleep. This sleep problem is common and is present in students around the world. In the U.S., 11.5% of undergraduate students were found to have DSPS (Brown, Soper, & Buboltz, 2001). Australian studies found the prevalence of DSPS in students (17%) to be higher than in adults (6-7%) (Lack, 1986; Lack, Miller, & Turner, 1988). Studies related to DSPS have also been conducted in Japan, Norway, and Taiwan (Hazama, Inoue, Kojima, Ueta, & Nakagome, 2008; Schrader, Bovim, & Sand, 1993; Yang, Wu, Hsieh, Liu, & Lu, 2003).

In Lack's (1986) study, the DSPS group experienced sleepiness on weekdays more often than the non-DSPS group. In addition, when course grades were examined, it was found that members of the DSPS group performed at a lower level academically when compared with the non-DSPS group. In a more recent study, Trockel et al. (2000) found that first-year college students with lower GPAs reported later bedtimes on weekdays and weekends and later wake-up times on weekdays and weekends.

Sleep and Academic Performance

The relationship between sleep and academic performance was reviewed in a previous study. Curcio, Ferrara, and Gennaro (2006) reviewed approximately 103 studies

related to sleep loss, learning capacity, and academic performance; samples included students of different education levels, from elementary school to university. Most (31 out of 37) studies involved elementary or high school students. The researchers concluded that sleep loss was negatively correlated with academic performance. They found that sleep-deprived students performed poorly on learning capacity skills such as attention, memory, and problem-solving tasks, and that the lack of sleep therefore affected their academic performance. Moreover, sleep loss resulted in daytime sleepiness that was also correlated with poor academic performance.

Sleep studies with college students have examined cognitive performance and GPA. In an experimental study involving 44 college student volunteers (68% response rate) from five psychology courses, Pilcher and Walters (1997) concluded that sleep-deprived participants had lower scores on cognitive tasks than non-sleep-deprived participants. However, Pilcher, Vander Wood, and O'Connell (2011) found no significant effects of sleep deprivation on cognitive performance when sleep deprived individuals worked on tasks in pairs rather than individually.

Two studies showed a significant relationship between lower GPA and lack of sleep among college students (Kelly, Kelly, & Clanton, 2001; Trockel et al., 2000). Trockel et al. (2000) studied the correlation between health-related variables and academic performance among 243 randomly selected first-year college students. Variables included sleep habits, academic performance, and several other health-related variables (e.g., stress, exercise, and work hours). Academic performance was measured using mean GPA and collected data were analyzed using Spearman's correlation analysis and stepwise regression analysis. The researchers found significant relationships between lower GPA and sleep-related variables.

Focusing on the relationship between sleep hours and GPA, Kelly et al. (2001) used a sample consisting of 147 college student volunteers (99% response rate) enrolled in a psychology course, collecting GPAs and data about sleep length using a self-report questionnaire. Based on self-reported sleep length, participants were divided into three groups: short sleepers (6 or fewer hours in a 24-hour period), average sleepers (7-8 hours in a 24-hour period), and long sleepers (9 or more hours in a 24-hour period). The researchers found that the mean GPA of short sleepers was 0.5 points lower than that of long sleepers (2.74 and 3.24, respectively). In another study, Horton and Snyder (2009) found a similar result in that hospitality students' GPAs were affected by physical wellness factors, such as amount of sleep.

Sleep and Job Performance

Job performance has been defined as "the level of productivity of an individual employee, relative to his or her peers, on several job-related behaviors and outcomes" (Babin & Boles, 1998, p. 82). Others have defined job performance as "the total expected value to the organization of the discrete behavioral episodes that an individual carries out over a standard period of time" (Motowidlo & Kell, 2003, p. 82). The influence of sleep on job performance has been discussed through clinical cases, national reports, and the financial cost of poor sleep habits. Snyder (2003) showed that nocturnal awakenings were negatively correlated with individual productivity. Mulgrew et al. (2007) found a significant relationship between sleepiness and job outcomes among 428 Canadian subjects (86% response rate) with a partial or complete upper airway obstruction.

In 2008, the National Sleep Foundation (2008) reported the results of their annual survey covering sleep, performance, and the workplace in the United States. Completed

surveys were obtained from 170 randomly selected healthy Americans (17% response rate) through telephone interviews. It also reported that 12% of the respondents admitted to being late to work due to sleepiness or sleep problems.

Organizations and businesses need to understand the importance of employee sleep, otherwise they may lose money. Rosekind et al. (2010) assessed the cost of poor sleep to employers. Employees at a number of companies in the United States participated in the study; 4,188 of them (16% response rate) completed an online questionnaire. The questionnaire included demographic items, sleep-related items, work performance items (e.g., memory, attention, and safety), and the Work Limitations Questionnaire (WLQ) which was used in a related study (Mulgrew et al., 2007). Based on WLQ calculations, the researchers concluded that decreased individual productivity resulting from poor sleep patterns cost each company an average of $1,967 per employee. The effects of sleep patterns on job performance have been studied in terms of sleep hours and sleep quality. Snyder (2003) showed that individuals who slept more than 9 hours had the highest productivity level. Rosekind et al. (2010) found that employees who slept poorly had poorer job performance than those who slept well. However, no known study to date has focused on the effects of sleep as it relates to job performance among college students.

Research Questions

The purpose of this study was to explore the effects of sleep on academic performance and job performance of undergraduate students, and to compare results between those who are working in the hospitality industry, those who are working in other industries, and those not working. The hospitality industry was selected for the following reasons: hospitality jobs have atypical work schedules (e.g. early hours, late hours, overnight hours) were common in this industry; and the university where the study was done had a hospitality management program and students were required to have work hours in the industry. Therefore, the following research questions are addressed:

1) How does sleep affect academic performance of undergraduate students?
2) How does sleep affect job performance of undergraduate students?
3) Is the relationship between sleep and academic performance different for undergraduate students working in the hospitality industry compared to those working in other industries?
4) Is the relationship between sleep and academic performance different for undergraduate students working in the hospitality industry compared to those who are not working?
5) Is the relationship between sleep and job performance different for undergraduate students working in the hospitality industry compared to those working in other industries?

Method

This research study was designed to analyze the relationship between sleep and two kinds of performance, academic performance and job performance, among undergraduate students. A self-report questionnaire was used in this study to measure sleep-related variables, academic performance, and job performance of undergraduate students. Institutional Review Board approval was received before any data collection started.

Population and Sample

The population selected for this study was undergraduate students at a public university located in the Midwest; this university was

chosen because it is the only public university in the area with a hospitality management program. A list of 23,990 undergraduate student e-mail addresses was obtained from the registrar's office. Before sampling, 8,079 students, who had missing data, were removed from the list (e.g., GPA or course credits). The list was then divided into two groups by gender and systematic sampling was used to select every sixth student from the two lists. This assured that gender representation was similar to that of the university at large. Systematic sampling was used instead of random sampling because the list was already in random order based on student identification number (Ary, Jacobs, & Sorensen, 2009). A total of 2,651 undergraduate students were selected for this study, 1,537 males and 1,114 females.

Data Collection

Instrument development. An online questionnaire was chosen as the method for data collection given the popularity and convenience of the Internet for students. The questionnaire had four sections as follows: demographics, sleep habits and sleep quality, academic performance, and job performance. The demographic section was created by the researchers and was developed based on a review of related literature. The demographic information was used to determine if the sample was similar to the population and to enable analysis of the data by sub-groups. For the sleep habits and sleep quality section, all items were adopted from the Pittsburgh Sleep Quality Index (PSQI). The PSQI has been found to be reliable (Cronbach's alpha = .80) and valid and has been used in previous sleep quality research (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002; Carpenter & Andrykowski, 1998). Student cumulative GPA and semester GPA were used to measure academic performance. Trockel et al. (2000) also used cumulative GPA and semester GPA as a measurement of academic performance in their study. The job performance section was adopted from a reliable instrument (Cronbach's alpha = .81) of job performance evaluation (Brown & Arendt, 2011).

Expert panel review and pilot study. To clarify the accuracy and meaning of each item, the questionnaire was reviewed by three educators who have expertise in fields related to this study. The questionnaire was revised as suggested by the review panel. A pilot study was completed with undergraduates in a hospitality management course not included in the final study sample. For this pilot study, 68 students pre-tested the on-line questionnaire and were then invited to provide feedback using a form designed for that purpose. Based on the feedback, it appeared that students understood the questions. Some technical problems with the on-line questionnaire occurred during the pilot study and these were fixed (e.g., page flow issues and one coding mistake).

Final instrument. An on-line final questionnaire with a cover letter was developed using SurveyGizmo™ software. The 48-item self-report questionnaire was divided into four sections. The first section, demographics, contained eight items: student ID, email address, gender, age, race/ethnicity, academic major, classification status (e.g., freshman, senior), and workplace.

The second section, focusing on sleep habits and sleep quality, had 22 items. These items measured the following: sleep habits, sleep hours, sleep latency, sleep disturbances, usage of sleeping medicine, daytime dysfunction, and sleep quality. Sleep habits and hours were scaled in time periods. For the rest of the measured items, with the exception of sleep quality, a 5-point Likert type scale ranging from 1 to 5 (1 = *never* to 5 = *always*) was used. For the sleep quality scale, the anchors for the scale were different (1 = *very bad* to 5 = *very good*). In the current study, the Cronbach's alpha for this section was .78 which showed good reliability (Ary et al., 2009).

The third section, academic performance, had four items. The first two asked how many cumulative credits the student had earned, and how many semester credits the student was taking at the time of the study. As a measure of academic performance, the other two items were the student's cumulative GPA, and semester GPA.

The fourth and final section, job performance, contained 14 items. Five items were related to the nature of the job: presence or absence of managerial/supervisory responsibility, work shift, getting enough sleep, paid work hours, and length of employment in current job. Nine items asked about performance-related components, including attendance, lateness, absenteeism, safety, work completion, motivation, attitude towards customers, judgment, and quality of work; these items used a 5-point Likert type scale ranging from 1 = *never* to 5 = *always*. In the current study, the Cronbach's alpha for this section was .70 which showed acceptable reliability (Ary et al., 2009).

Procedures. A recruitment email with the link to the online questionnaire was sent to 2,651 systematically sampled undergraduate students in the middle of the fall semester. The data collection period was four weeks. To increase response rate, a reminder was emailed to those who had not yet responded to the questionnaire by the third week of the data collection period, as is recommended (Dillman, Smyth, & Christian, 2007). To validate self-reported data, student GPA and credits were obtained from the registrar's office. Student identification numbers and email address were required for linking GPA and credits with responses. To ensure no individuals could be personally identified, student identification numbers and email addresses were immediately removed from the full dataset and used only for acquiring GPA and credits.

Data Analysis

The data were exported in SPSS Version 19.0 (2010), a statistical analysis software program. Mean or mode imputation was used to replace missing data; this technique is frequently used (Batista & Monard, 2003). For comparison, participants were divided into three groups based on their employment status: those who were working in the hospitality industry, those who were working in other industries, and those who were not working. Working in the hospitality industry was defined as employment in the restaurant industry or the lodging industry (e.g., campus dining/university dining, quick service restaurant, family restaurant, commercial cafeterias, causal restaurant, casual upscale dining restaurant, fine-dining restaurant, health care foodservice, hotel) (Powers & Barrows, 2006).

Descriptive statistics were used to analyze the demographic information. T-tests were used to compare the relationships among sleep, academic performance, and job performance between various student groups. Principal component analysis was used to find factors for the ten sleep disturbance items. To improve interpretation, oblimin rotation was used when there were correlations between items (Field, 2009). Only factors with eigenvalues greater than one were retained, as recommended by Kaiser (1960). Principal component analysis revealed three distinct factors of the sleep disturbance variable: physical sleep disturbances, environmental sleep disturbances, and medical sleep disturbances. Finally, a total of seven sleep-related variables were used in stepwise regression as follows: sleep latency, physical sleep disturbances, environmental sleep disturbances, medical sleep disturbances, usage of sleeping medicine, daytime dysfunction, and sleep quality. The backward method of stepwise regression was used to determine whether sleep-related variables were significantly related to academic performance and job performance. In

the backward method, a predicted variable explaining the smallest part of the model was removed in each step. This method decreased the possibility of missing predictors (Field, 2009).

Results

A total of 206 responses (7.8% response rate) were collected from the on-line questionnaire with 48 items. The researchers received 145 responses in the first two weeks and an additional 62 responses after the reminder was sent. However, 34 students answered less than half of the questionnaire so those questionnaires were not analyzed. An additional 22 respondents missed only 1 to 14 questions, so the missing data was replaced using mode imputation which is a frequently used technique (Batista & Monard, 2003). Therefore, 172 questionnaires were usable (6.5% response rate) for data analysis.

Table 4.1 Demographics of Sample (N=172)

Characteristic	n	%
Gender		
Female	104	60.5
Male	68	39.5
Age		
18-24	166	96.5
25-34	4	2.3
35-44	2	1.2
Race/Ethnicity		
African-American (non-Hispanic)	3	1.7
Asian/Pacific Islanders	14	8.1
Caucasian (non-Hispanic)	144	83.7
Latino or Hispanic	9	5.2
Others	2	1.2
Academic Major		
Hospitality management or events	6	3.5
A major other than hospitality management or events	166	96.5
Classification Status		
Sophomore	46	26.7
Junior	61	35.5
Senior	65	37.8
Employment		
Working in the hospitality industry	24	14.0
Working in other industries	93	54.1
Not working	55	32.0

Descriptive Statistics

Demographics of sample. Table 4.1 shows the demographics of the sample. A majority of the participants were female (60.5%) and most were Caucasian (83.7%). The most prevalent age range of participants was between 18 and 24 years (96.5%). Most of the participants had a major other than hospitality management or events (96.5%). The most common class rank was seniors (37.8%). A majority of the participants (54.1%) were employed in industries other than the hospitality industry; about a third (32%) of the participants were not working.

Sleep habits and sleep hours. Table 4.2 presents the sleep habits and sleep hours of participants. On weekdays, the greatest percentage of participants went to bed between 12am and 12:59am (36.0%) and got up between 7am and 7:59am (37.8%). On weekends, the greatest percentage of participants went to bed between 2am and 4:59am (36.6%) On weekends, the greatest percentage of participants got up either between 9am and 9:59am (26.2%) or between 10am and 10:59am (26.2%). Most participants (33.1%) took 5 to 15 minutes to fall asleep. Half of participants (50.0%) reported actual sleep hours between 7 to 8.5 hours. A majority of participants (65.7%) reported they needed 7 to 8.5 hours to function best.

Credits and grade point average (GPA). According to the report from the registrar's office, the mean number of cumulative credits

Table 4.2 Sleep Habits and Sleep Hours (N=172)

Characteristic	n	%
Go to bed on weekdays		
9pm-9:59pm	3	1.7
10pm-10:59pm	23	13.4
11pm-11:59pm	48	27.9
12am-12:59am	62	36.0
1am-1:59am	24	14.0
2am-4:59am	11	6.4
11am-1:59pm	1	0.6
Get up on weekdays		
5am-5:59am	7	4.1
6am-6:59am	28	16.3
7am-7:59am	65	37.8
8am-8:59am	48	27.9
9am-9:59am	17	9.9
10am-10:59am	4	2.3
8pm-10:59pm	1	0.6
2am-4:59am	2	1.2
Go to bed on weekends		
10pm-10:59pm	5	2.9
11pm-11:59pm	25	14.5
12am-12:59am	24	14.0
1am-1:59am	51	29.7
2am-4:59am	63	36.6
5am-7:59am	2	1.2
2pm-4:59pm	2	1.2
Get up on weekends		
5am-5:59am	2	1.2
6am-6:59am	2	1.2
7am-7:59am	12	7.0
8am-8:59am	30	17.4
9am-9:59am	45	26.2
10am-10:59am	45	26.2
11am-1:59pm	35	20.3
2pm-4:59pm	1	0.6
Time to fall asleep		
Less than 5 min	25	14.5
5-15 min	57	33.1
16-30 min	40	23.3
31-45 min	28	16.3
46-60 min	17	9.9
1hr-1hr15min	4	2.3
1hr16min-1hr30min	1	0.6
Actual sleep hours		
less than 3 hours	0	0.0
3-4.5 hours	8	4.7
5-6.5 hours	74	43.0
7-8.5 hours	86	50.0
9-10.5 hours	4	2.3
Hours of sleep to function best		
less than 3 hours	2	1.2
3-4.5 hours	3	1.7
5-6.5 hours	20	11.6
7-8.5 hours	113	65.7
9-10.5 hours	34	19.8

among students in the sample was 55.90 (*SD* = 29.18). The mean number of semester credits was 14.30 (*SD* = 2.64). Mean cumulative GPA was 3.11 (*SD* = 0.60) and mean semester GPA was 3.10 (*SD* = 0.72). Comparing the official data with self-reported data, a majority of participants accurately reported their semester credits, cumulative GPA, and semester GPA.

Employment status. Among students who were working (*n* = 117), most of them had worked one to two years at their current jobs (39.3%) and averaged 11 to 20 hours (57.3%) per week (Table 4.3). Twenty-five participants (21.4%) had managerial or supervisory responsibilities. A majority worked the day shift (53.8%). Over three-fourths of participants (77.8%) agreed or strongly agreed that their work schedules allowed them to get enough sleep.

Comparison Between Groups

Sleep. As shown in Table 4.4, participants who were working in the hospitality industry reported a higher frequency of trouble falling asleep due to feeling too cold than those who were not working (*M* = 2.46 and *M* = 1.93, respectively). Participants who were working in the hospitality industry also reported more often having trouble staying awake in class than those who were not working (*M* = 3.13 and *M* = 2.60, respectively). A higher frequency of waking up in the middle of the night or early morning was reported by participants who had a job as compared to those who did not have a job (*M* = 2.91 and *M* = 2.56, respectively). In addition, those with a job more often reported feeling too cold to sleep than

Table 4.3 Employment Status

Characteristic	Hospitality (*n*=24)		Others (*n*=93)		Total (*n*=117)	
	n	%	n	%	n	%
Have managerial or supervisory responsibility						
Yes	9	37.5	16	17.2	25	21.4
No	15	62.5	77	82.8	92	78.6
Work shift						
Day shift	8	33.3	55	59.1	63	53.8
Evening shift	8	33.3	17	18.3	25	21.4
Overnight shift	1	4.2	1	1.1	2	1.7
Different shifts	7	29.2	20	21.5	27	23.1
Work schedule allows enough sleep						
Strongly disagree	1	4.2	1	1.1	2	1.7
Disagree	3	12.5	4	4.3	7	6.0
Neutral	5	20.8	12	12.9	17	14.5
Agree	11	45.8	54	58.1	65	55.6
Strongly agree	4	16.7	22	23.7	26	22.2
Average work hours each week						
Less than or equal to 10 hours	1	4.2	32	34.4	33	28.2
11-20 hours	19	79.2	48	51.6	67	57.3
21-30 hours	4	16.7	7	7.5	11	9.4
31-40 hours	0	0.0	5	5.4	5	4.3
More than 40 hours	0	0.0	1	1.1	1	0.9
Started current job						
Less than 6 months ago	9	37.5	29	31.2	38	32.5
6 months to less than a year ago	3	12.5	14	15.1	17	14.5
1-2 years ago	10	41.7	36	38.7	46	39.3
3-4 years ago	1	4.2	10	10.8	11	9.4
More than 4 years ago	1	4.2	4	4.3	5	4.3

did those without a job (M = 2.23 and M = 1.93, respectively) (Scale 1=*never*, 2=*rarely*, 3=*sometimes*, 4=*usually*, 5=*always*).

Work shift and work hours. As shown in Table 4.3, among participants who had a job (n = 117), a higher percentage of those who were working in the hospitality industry worked evening shift (33.3%), overnight shift (4.2%), or rotating shifts (29.2%) than those who were working in other industries (18.3%, 1.1%, and 21.5%, respectively). A majority of participants (79.2%) who were working in the hospitality industry worked 11 to 20 hours. This percentage was 27.6% higher than among participants who were working in other industries with 11 to 20 work hours (51.6%).

Job performance. Table 4.5 shows the mean and standard deviation of job performance overall and for each item for participants working in the hospitality industry and in other industries. Participants employed

Table 4.4 Comparison of Sleep-related Variables

Industry working in	Hospitality (*n*=24)		Others (*n*=93)		No work (*n*=55)		Total (*N*=172)	
Variables Items	Mean[a]	SD	Mean	SD	Mean	SD	Mean	SD
Sleep latency	**2.88**	**1.08**	**2.60**	**1.08**	**2.65**	**1.08**	**2.66**	**1.08**
Sleep disturbances	**2.13**	**0.63**	**2.14**	**0.59**	**2.04**	**0.53**	**2.11**	**0.58**
Nocturnal awakenings	2.75	1.29	2.95	1.12	2.56	1.00	2.80	1.11
Use bathroom	2.04	1.00	2.02	1.06	2.13	1.07	2.06	1.05
Trouble breathing	1.54	0.98	1.52	0.92	1.47	0.90	1.51	0.91
Cough or snore	1.83	0.96	1.77	1.04	1.75	1.14	1.77	1.06
Feel too cold	2.46*	0.93	2.17	0.89	1.93*	0.88	2.13	0.90
Feel too hot	2.54	1.10	2.43	0.95	2.36	1.04	2.42	1.00
Have dreams	2.83	1.27	3.03	1.26	2.90	1.27	2.96	1.26
Have pain	1.71	1.00	1.59	0.82	1.51	0.84	1.58	0.85
Roommate	1.71	1.12	1.95	1.16	1.75	1.11	1.85	1.13
Noisy environment	1.88	1.03	2.00	1.03	2.09	1.02	2.01	1.03
Usage of sleep medicine	**1.58**	**1.02**	**1.43**	**0.84**	**1.49**	**0.88**	**1.47**	**0.87**
Daytime dysfunction	**2.67**	**0.83**	**2.31**	**0.74**	**2.25**	**0.88**	**2.34**	**0.81**
Trouble awaking in social activity	2.21	0.98	1.92	0.82	1.91	0.91	1.96	0.87
Trouble awaking in class	3.13*	0.95	2.70	1.00	2.60*	1.05	2.73	1.01
Sleep quality	**3.13**	**0.85**	**3.09**	**0.87**	**3.27**	**1.03**	**3.15**	**0.92**

[a]A 5-point Likert type scale ranging from 1 to 5 (1 = *never* to 5 = *always*) was used in this section.
*$p < .05$.

in non-hospitality industries reported more often working without making mistakes than those employed in the hospitality industry ($M = 4.13$ and $M = 3.79$, respectively) (Scale 1=*never*, 2=*rarely*, 3=*sometimes*, 4=*usually*, 5=*always*).

Principal Component Analysis

Sleep disturbances. The mean scores, standard deviations, and principal component analysis for the ten sleep disturbance items, derived using principal component analysis with oblimin rotation, are shown in Table 4.6. Factor loadings of each sleep disturbance items were greater than the generally practical value of ±.50 (Hair, Black, Babin, Anderson, & Tatham, 2005). Two items, use bathroom and have pain, were not included in any factors due to factor loadings lower than .50. Factor one was labeled physical sleep disturbances (e.g., have dreams, feel too hot, feel too cold, wake up in the middle of the night or early morning). Factor two was labeled environmental sleep disturbances (e.g., have a roommate who negatively affects sleep habits or sleep quality, live in a noisy environment). Factor three was labeled medical sleep disturbance (e.g., coughing or snoring, cannot breathe comfortably).

Simple Regression

Multiple linear regression analysis was used to determine the effects of sleep on academic performance and job performance. Seven sleep-related variables were used as follows: sleep latency, physical sleep disturbances, environmental sleep disturbances, medical sleep disturbances, sleep medicine,

Table 4.5 Comparison of Job Performance

Industry working in	Hospitality (n=24)		Others (n=93)		Total (n=117)	
Variables Items	Mean[a]	SD	Mean	SD	Mean	SD
Job Performance	**4.32**	**0.29**	**4.32**	**0.41**	**4.32**	**0.39**
Attendance	4.67	0.56	4.47	0.76	4.51	0.73
Judgment	4.21	0.41	4.20	0.56	4.21	0.53
Absenteeism[b]	4.71	0.55	4.47	0.73	4.52	0.70
Accidents[b]	4.42	0.65	4.65	0.79	4.60	0.77
Work completion	4.46	0.88	4.51	0.67	4.50	0.71
Motivation	3.75	0.61	3.71	0.80	3.71	0.76
Attitude towards customers	4.58	0.50	4.33	0.83	4.38	0.78
Lateness[b]	4.33	0.76	4.38	0.78	4.37	0.77
Quality of work (no mistakes)	3.79*	0.72	4.13*	0.58	4.06	0.62

[a]A 5-point Likert type scale ranging from 1 to 5 (1 = *never* to 5 = *always*) was used in this section.
[b]Scores of these items were reversed because they were negatively worded for job performance.
*$p < .05$.

daytime dysfunction, and sleep quality. Separate models were constructed for cumulative GPA, semester GPA, and job performance. However, no significant relationships were identified between the two kinds of performance (academic and job) and sleep. Stepwise regression analysis was used to determine which sleep-related variables were the best predictors of the main effect on academic performance or job performance by removing one variable at a time. Three simple regressions were retained in the final regression analysis as follows: academic performance and sleep latency; academic performance and sleep medicine; and job performance and sleep quality.

Relationship between academic performance and sleep. Results of the stepwise regression analysis of academic performance are presented in Table 4.7. As shown, the

Table 4.6 Mean Scores, Standard Deviations, and Factor Loadings of Sleep Disturbance Items

Items	Mean[a]	SD	Factor Loading		
			Factor 1	Factor 2	Factor 3
Hot	2.42	1.00	**.752**[b]	.108	-.024
Dream	2.96	1.26	**.746**	-.099	-.036
Wake up	2.80	1.11	**.689**	.174	-.045
Cold	2.13	0.90	**.620**	-.179	.254
Roommate	1.85	1.13	.021	**.880**	.019
Noisy environment	2.01	1.03	.017	**.857**	.064
Cough	1.77	1.06	-.019	-.050	**.884**
Trouble breathing	1.51	0.91	.021	.145	**.774**

[a]A 5-point Likert type scale ranging from 1 to 5 (1 = *never* to 5 = *always*) was used in this section.
[b]Factor loadings greater than .50 are in boldface type.

Table 4.7 Results of Simple Regression Analysis

DV	IV	Coefficients		R^2
		B	SE	
Cumulative GPA	Sleep latency	-.116**	.041	.044
Semester GPA	Sleep medicine	-.148*	.062	.032
Job performance	Sleep quality	.131**	.040	.086

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

regression model confirmed the negative effect of sleep latency on cumulative GPA (slope = -.116, $p = .006$). The negative effect of sleep medicine on semester GPA (slope = -.148, $p = .019$) is shown as well.

Relationship between job performance and sleep. Results of the stepwise regression analysis of job performance are also presented in Table 4.7. Sleep quality was the only variable to show an effect on job performance (slope = .131, $p = .001$).

Discussion and Conclusions

The purpose of this study was to explore the relationship between sleep and performance among undergraduate students. Educators want students to be successful in their classes while employers want students to excel in the workplace; therefore, both academic performance and job performance were the focus of this study. In this section we first begin by providing a comparison between study sample and university population. Second, we address some understandings of the results related to DSPS and sleep hours. Third, we discuss the differences in sleep and employment status between students working in the hospitality industry, those working in other industries, and those not working. Fourth, the relationships between sleep, academic performance and job performance are discussed. Finally, we offer a comparison of those relationships (sleep, academic performance and job performance) between students working in the hospitality industry, those working in other industries, and those not working.

Sample Comparison to Population

By comparing the study sample to the university population comprised of sophomores, juniors, and seniors, we determined the division by classification was similar. It was as follows (study sample and university population, respectively): sophomores (26.7% and 27.8%), juniors (35.5% and 30.2%), and seniors (37.8% and 39.4%). Freshmen were not included because students at that level have not established a GPA and their sleep patterns may not reflect that of the other classifications due to a lack of orientation to a new lifestyle in college. However, the structure of gender for the comparison was opposite to the entire population, as follows (study sample and university population): female (60.5% and 43.6%) and male (39.5% and 56.4%). This result is likely because females are more willing than males to participate in surveys (Porter & Whitcomb, 2005).

DSPS and Sleep Hours

We next present out understanding of the results related to DSPS and sleep hours. In the current study, symptoms of DSPS were found in undergraduate students as evidenced by their self-reported sleep habits. This study found that students went to bed later and got up later on weekends as compared to weekdays. On weekends, over half of the students went to bed between 1am and 4:59am (66.3%) and got up between 9am and 10:59am (52.4%). However, on weekdays over half of the students went to bed between 11pm and 12:59 am (63.9%) and got up between 7am

and 8:59am (65.7%). According to Weitzman et al. (1981), going to bed late and getting up late on weekends to achieve a normal length of sleep is one DSPS criterion. Other criteria of DSPS include long sleep latency on weekdays (usually falling asleep between 2 a.m. to 6 a.m.) and difficulty staying asleep. Lack (1986), using the definition of DSPS by Weitzman et al. (1981), found that the prevalence of DSPS in his sample of Australian students was 17%. Although DSPS students could not be identified in this study, over half of students' self-identified sleep habits were going to bed later and getting up late on weekends than weekdays indicating that the possibility of the students in this study having DSPS may be high. Because researchers have found that students with DSPS had lower GPAs than students without DSPS (Lack, 1986; Trockel et al., 2000). Thus, DSPS-related issues should be a concern for educators in higher education.

Students in this study reported sleep hours similar to those of the entire population of the U.S., based on data from a national sleep report. In this study, most students reported that they needed 7 to 8.5 hours of sleep per night to function best. The National Sleep Foundation (2008) reported that Americans expect to average 7 hr 18 min of sleep per night. Half of students in this study achieved their expected sleep hours but 43% reported that they only slept 5 to 6.5 hours. Overall, Americans sleep an average of 6 hr 40 min per day (National Sleep Foundation, 2008).

Sleep and Employment Status

We next compared the differences in sleep and employment statuses between students working in the hospitality industry, other industries, and those who were not working. The hospitality industry was chosen because it often requires a demanding and erratic work schedule, which has been shown to impact personal health and sleep (Cleveland et al., 2007; Wyatt, 2001). Overall, students employed in the hospitality industry reported a higher frequency of trouble staying awake in class and trouble falling asleep than those who were not working. For students with jobs, those working in the hospitality industry reported working evening shifts (33.3%), overnight shifts (4.2%), or various rotating shifts (29.2%) more often than those working in other industries (18.3%, 1.1%, and 21.5%, respectively). In terms of job performance, the frequency of employee mistakes differed significantly between the hospitality industry and other industries. Students working in non-hospitality industries reported fewer mistakes than their counterparts. Trouble sleeping and work scheduling may be two of the reasons for low job performance among students working in the hospitality industry. When student's academic performance was compared between the three groups, no statistically significant differences were found.

Sleep, Academic Performance and Job Performance

We will now discuss the relationships among sleep, academic performance and job performance. An earlier study on the relationship between sleep and academic performance by Curcio et al. (2006) concluded that sleep loss was negatively correlated with academic performance. Moreover, sleep loss resulted in daytime sleepiness, which was also correlated with poor academic performance. Kelly et al. (2001) and Trokel et al. (2000) found a significant relationship between lower GPAs and lack of sleep. Findings of the current study showed that sleep latency was negatively correlated to cumulative GPA and sleep medication was negatively correlated to semester GPA. Although most students in the current study took 5 to 15 min to fall asleep, 25% reported that they took 30 min to one hour to fall asleep. Because long sleep latency was one of the criteria of DSPS with

which students reported low GPAs (Lack, 1986; Trockel et al., 2000; Weitzman et al., 1981), understanding the impact of sleep latency on academic performance is important for educators.

In a previous study on the relationship between sleep and job performance, individual productivity was found to be affected by two sleep-related variables, nocturnal awakenings and sleepiness (Mulgrew et al., 2007; Snyder, 2003). The National Sleep Foundation (2008) reported that 12% of the respondents admitted to missing events due to sleepiness or sleep problems. In the current study, job performance was significantly related to sleep quality. A similar result was found by Rosekind et al. (2010). The impact of sleep quality on job performance should be relevant when managers make employee-related decisions such as deciding work shifts and setting performance standards. Likewise, employee safety considerations are paramount as other researchers have found employees who sleep poorly pose a safety issue at work (Mulgrew et. al, 2007). Although we found the relationships, the value of R^2 is small. We should consider including other variables into our models. If we find that sleep has a greater impact than found in this current study, we may be able to better explain how sleep affects academic and job performance.

When we compared students working in the hospitality industry with those working in other industries or not working at all, no significantly statistical differences were found in the relationships between sleep, academic performance, and job performance. Pilcher et al. (2011) studied differences between cognitive performance and sleep and also found no significant differences. However, for their study (Pilcher et al., 2011) cognitive performance tasks were done in pairs potentially contributing to why no differences were found.

Limitations

This study did have some limitations. Although the response rate was sufficient for the statistical techniques used, the sample size of students who worked in the hospitality industry was relatively small when compared to the other groups. Because this study was conducted in only one university, results may not be generalizable to students at other universities. Even though student GPAs were obtained from the registrars' office, the other information collected from participants was self-reported and therefore might be biased.

Future Research

There are several opportunities for future research in this area. As an initial step, the research topic and the instrument used in this study might be applied to future studies, expanding the understanding of the relationship between sleep and performance. If DSPS has an impact on academic performance, then the importance of sleep habits, sleep latency, and sleepiness should be called to the attention of both students and faculty as part of their educational program. If sleep habits and sleep latency have an impact on sleep quality, it might affect students' job performance as well. Future research should examine the impact of DSPS on academic performance and/or job performance.

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