

THE IMPACT OF WORK TYPE, SOCIOECONOMIC STATUS, AND SLEEP
CHARACTERISTICS ON ACADEMIC PERFORMANCE IN COLLEGE STUDENTS

By

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Abstract

This study investigated the role of socioeconomic status (SES) as a factor of work type and as a predictor of cumulative GPA. Further, it examined the impact of work type on the relationship between sleep and academic performance. It was predicted that: (1) students with lower parental SES are more likely to work shift work than students with higher parental SES; and (2) students with shift work schedules will have worse academic performance and poorer sleep than non-working college students and non-shift work student workers. The sample consisted of 907 students from a single Midwestern university categorized into four different work type groups (i.e., unemployed, day, shift, combination). The participants completed an investigator-designed questionnaire on demographic and lifestyle choices, along with a 7-day sleep diary. The data was analyzed using hierarchical multiple regressions and Post-Hoc LSD tests. Findings showed that unemployed students had the highest GPA, while the combination work type group reported the lowest GPA. The combination work type group also had the highest reported SES, while daytime workers reported the lowest SES. For unemployed, day, and shift-working groups, increased consistency of TST and sleep midpoint predicted higher GPA. For the combination work type group, the consistency of sleep midpoint was the only significant variable in predicting GPA; an increase in consistency of sleep/rise times predicted better academic performance. The results indicated that the consistency of sleep is more significant than a single night's. Further, findings suggest that SES indirectly affects sleep through its influence on student's work type.

Keywords: socioeconomic status, academic performance, GPA, total sleep time, sleep midpoint, sleep efficiency, shift work, intra-individual variability

The Impact of Work Type, Socioeconomic Status, and Sleep Characteristics on Academic Performance in College Students

According to a study conducted by Walpole (2003), socioeconomic status (SES) plays a significant role in a student's college experience. Students with less parental support (e.g., SES) are more likely to work during college, which can affect their engagement in clubs, groups, and studying; the findings report that low SES students have a lower level of involvement in student activities (Walpole, 2003). However, students accumulate more economic capital by working while in school (Walpole, 2003). It's reported that over half (52%) of low SES students work 16+ hours per week or full time, whereas over a third (37%) of high SES students reported the same (Walpole, 2003). Consequently, low SES students report lower GPA's and less time spent studying than their high SES peers (Walpole, 2003).

Shift work is common among the college population and is defined as work that takes place outside the traditional work hours of 9 am – 5pm (Jehan et al., 2017). This work is common in many professional settings (e.g., healthcare, food industry), including places where the working population mainly consists of college students (Pacheco, 2020). Shift workers often experience sleep disturbances, including insomnia and shift work disorder, which results in excessive daytime sleepiness (Taylor et al., 2011). These disturbances occur due to a lack of synchronicity between one's circadian rhythm and sleep/wake schedule (Santhi et al., 2005). Those who have a fixed sleep schedule tend to adapt better than those who have an inconsistent sleep schedule (i.e., more IIV; Horowitz et al., 2001). Working students are required to navigate and manage work and school schedules, which may result in working at unconventional work times (i.e., shift work).

When looking at sleep as a predictor of academic performance, previous findings suggest that specific sleep variables (e.g., mean as well as intra-individual variability [IIV] of total sleep time [TST]) are unique predictors of college GPA (Taylor et al., 2013). Additionally, a study conducted by Hysing et al (2016), indicated that those with a sleep efficiency percentage greater than 90% have the highest GPA (4.0) compared to adolescents with a sleep efficiency lower than 75%. The students with less than 75% sleep efficiency reported GPA's of approximately 3.5 (Hysing et al., 2016). Finally, studies have shown a strong inverse relationship between evening preference and academic achievement in university students, leading to the finding that early sleep midpoint is associated with better grades (Arbabi et al., 2015; Randler & Frech, 2006).

To better understand the relationship between SES, shift work, and sleep (i.e., TST, SE, and midpoint) with academic performance in college students, we examined the main effects and interaction of SES, work type (i.e., unemployed, day, shift, combination), and sleep characteristics (see above) as predictors of cumulative GPA. We predicted that: (1) students with lower parental SES would be more likely to work shift work than students with higher parental SES; and (2) students with shift work schedules will have poorer sleep (e.g., low TST, low SE, later midpoint), and thus worse academic performance, than non-working college students and non-shift work student workers.

Methods

Participants

A survey was completed by 1,074 students from a Midwestern university. Students were primarily recruited from core curriculum classes at the university, allowing for various majors to be represented. Students that did not complete the 7-day daily sleep diary or report parent(s) income or years of education were excluded from analysis, resulting in a final sample of 907

students. The sample was 74.8% female, with a mean age of 20.3 years ($SD = 3.8$). The sample ethnicity was 66.5% Caucasian, 13% African American/Black, 11.6% Hispanic/Latinx, 6% Asian/Pacific Islander, and 2.9% mixed ethnicities.

Procedure

The study was approved by the Midwestern university's IRB. All participants consented to the study and signed a form allowing the lab to receive participant transcripts. Students completed an investigator-designed questionnaire on demographic and lifestyle choices, along with a 7-day daily sleep diary (see Appendix). The questionnaire obtained information about participants' gender, age, ethnicity, standardized test scores (i.e., SAT/ACT), academic rank, employment status, type of employment, and work schedule. Participants accessed the consent form, questionnaire, and sleep diary through the UNT Department of Psychology's undergraduate research participant pool website (SONA system). Data collection occurred during the Fall 2006 and Spring 2007 semesters; the collection period started one week after the start of the semester and ended prior to the start of finals.

Materials

7-day Daily Sleep Diary

Participants were asked to complete a sleep diary every morning for seven days. The sleep diary asked for a record of their sleep activity from the night before and their wake/rise times that morning. Information gathered included estimates of bedtime, sleep onset latency (SOL), number of awakenings during the night (NWAK), total wake time after sleep onset (WASO), time spent in bed after final awakening in the morning (TWAK), total time spent in bed (TIB), TST, SE, midpoint, and time spent napping during the day (Nap). TST was calculated by the following equation: $TST = TIB - SOL - WASO - TWAK$. SE was calculated by the

following equation: $SE = TST/TIB \times 100$. Midpoint was calculated by the following equation: $Midpoint = (wake\ time - bedtime)/2$. IIV is the intraindividual standard deviation of sleep variables (i.e., TST, SE, sleep midpoint). From this point forward, IIV will be referred to as “consistency.”

Investigator-designed Questionnaire

Socioeconomic Status. SES was calculated by taking the sum of parental education and/or parental income Z-scores; the calculation, using either education or income, accounted for students that did not have a household with both parents present.

Employment. The work type variable was created through several steps. Participants’ employment status was first assessed; if the student reported unemployment, they would be placed into the unemployed group. Further, if the participant reported working during the day, they would be placed into the daytime group; if they reported working during the night/overnight, they would be placed into the shift work group; and if the student documented working a combination of day and night, they would be placed in the combination work group.

Academic Performance. Academic performance was measured by the student’s cumulative GPA (0.0 – 4.0 scale). Student GPA’s were obtained from academic transcripts with participant consent.

Results

Participants were split into groups depending on work type (unemployed, day, shift work, and a combination of shift and day work [combination]). There was a statistically significant difference in cumulative GPA based on the student’s work type, $F(6, 1758) = 2.92, p = .008$; Wilk’s $\Lambda = .98$. Specifically, whether or not students were employed and time of day of work

were significantly related to cumulative GPA, $F(3, 880) = 2.99, p = .03$, and SES $F(3, 880) = 2.96, p = .031$.

Using LSD Post-Hoc Tests, it was found that unemployed students ($M = .1, SD = 2.1$) had the highest cumulative GPA (see Figure 1). These students had significantly higher GPA's than shift ($p = .032$) and combination ($p = .021$) work type groups. Unemployed students also had significantly higher SES than daytime-working students ($p = .005$); daytime working students reported lowest SES ($M = -.3, SD = 2.3$; see Figure 2). Those who worked a combination of daytime and shift work had the lowest cumulative GPA ($M = -.3, SD = 1.1$) and highest SES ($M = .2, SD = 1.6$; see Figures 1 & 2).

Within work type groups, hierarchical multiple regression analyses were conducted to test TST, SE, sleep midpoint, and their consistency (i.e., IIV) as predictors of cumulative GPA examining for gender, race/ethnicity, SES, and standardized test scores (i.e., SAT, ACT) effects. Results from the hierarchical multiple regression analyses can be found in Tables 1-4.

Figure 1
Estimated Marginal Means of Cumulative GPA by Work Type

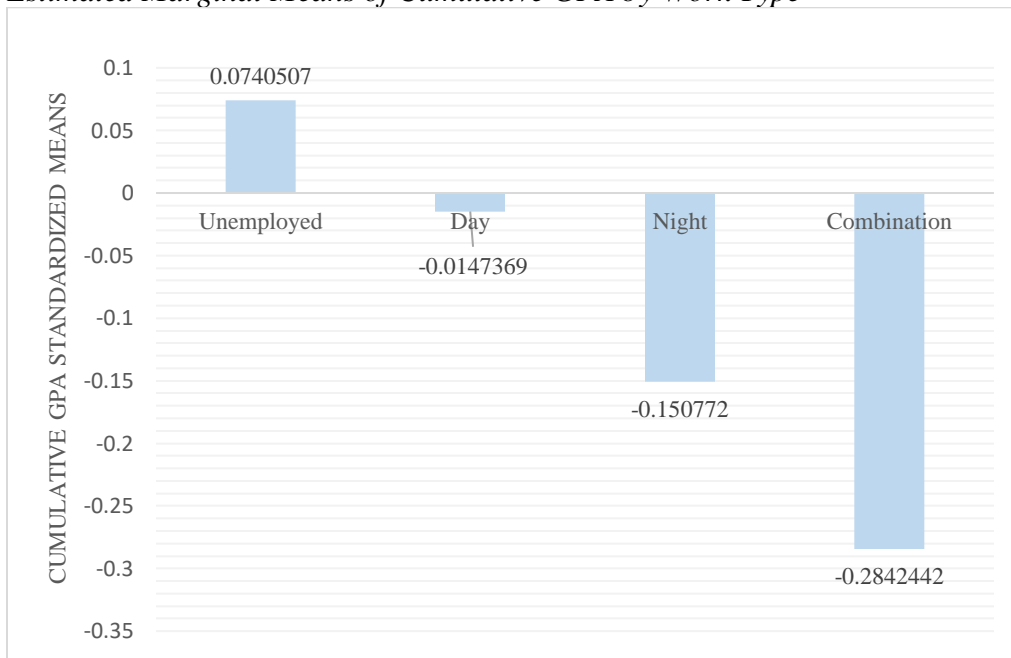
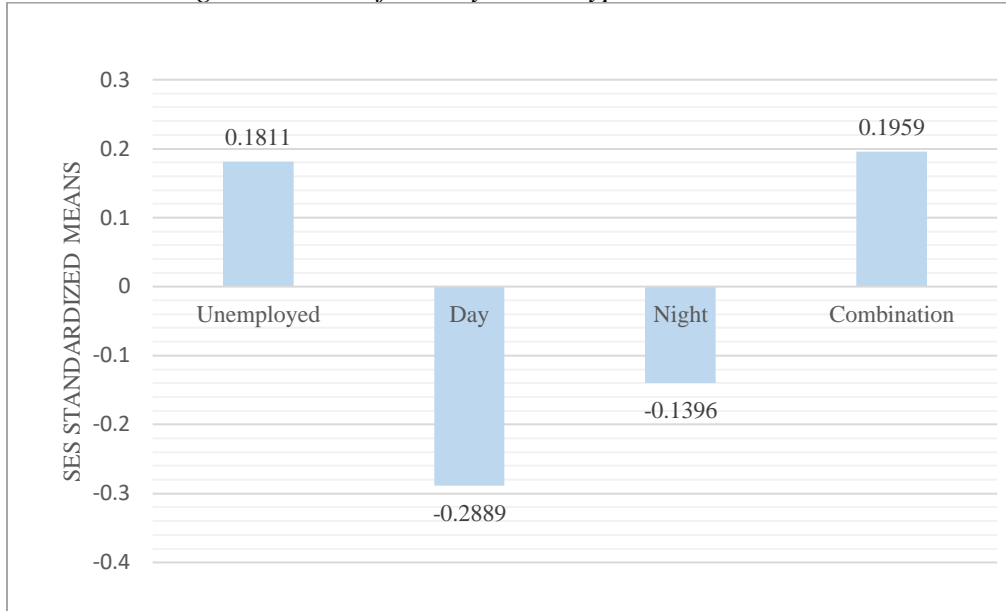


Figure 2
Estimated Marginal Means of SES by Work Type



Unemployed

As seen in Table 1, higher standardized test scores predicted higher cumulative GPA, $\beta = .31, p < .001$, and women were more likely to have higher GPA's, $\beta = -.14, p = .003$. Beyond standardized test score and gender effects, greater consistency of TST ($\beta = -.17, p < .001$) and sleep midpoint ($\beta = -.15, p = .002$) were significant for predicting higher GPA in unemployed. Consistency of SE trended towards significance, $\beta = -.12, p = .095$.

Table 1
Predicting Cumulative GPA in Unemployed Students

	<i>B</i>	<i>SE</i>	β	<i>R</i> ²
Model 3 Unemployed				.126
Standardized Test Scores	.438	.067	.313***	
Gender	-.312	.103	-.145**	
Race/Ethnicity	.039	.053	.022	
SES	.039	.053	.054	
TST	-.048	.046	-.049	
IIV of TST	-.155	.044	-.168***	
Midpoint	-.040	.045	-.043	
IIV of Midpoint	-.137	.043	-.150**	
SE	-.027	.068	-.027	
IIV of SE	-.122	.073	-.114	

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Daytime

As seen in Table 2, higher standardized test scores predicted higher cumulative GPA, $\beta = .30, p < .001$. Beyond standardized test score effects, greater consistency of TST ($\beta = -.24, p < .001$) and sleep midpoint ($\beta = -.25, p = .001$) were significant in predicting higher GPA in daytime workers.

Table 2
Predicting Cumulative GPA in Daytime Working Students

	<i>B</i>	<i>SE</i>	β	<i>R</i> ²
Model 3 Day				.136
Standardized Test Scores	.455	.108	.297***	
Gender	-.100	.074	-.074	
Race/Ethnicity	-.100	.074	-.090	
SES	-.100	.074	.027	
TST	-.008	.066	-.009	
IIV of TST	-.249	.074	-.238***	
Midpoint	.026	.069	.026	
IIV of Midpoint	-.260	.074	-.247**	
SE	.004	.108	.005	
IIV of SE	-.001	.111	-.001	

*Note: *p < .05, **p < .01, ***p < .001*

Shift Work

As seen in Table 3, greater consistency of TST ($\beta = -.36, p < .001$) and sleep midpoint ($\beta = -.33, p = .002$) were significant in predicting higher cumulative GPA.

Table 3
Predicting Cumulative GPA in Shift Work Students

	<i>B</i>	<i>SE</i>	β	<i>R</i> ²
Model 3 Shift				.111
Standardized Test Scores	-.109	.113	-.012	
Gender	-.109	.113	-.034	
Race/Ethnicity	-.109	.113	.039	
SES	-.109	.113	-.163	
TST	-.128	.130	-.101	
IIV of TST	-.384	.110	-.358***	
Midpoint	-.121	.126	-.099	
IIV of Midpoint	-.364	.113	-.333**	
SE	-.085	.189	.066	
IIV of SE	-.169	.161	-.155	

*Note: *p < .05, **p < .01, ***p < .001*

Combination of Day and Shift Work

As seen in Table 4, greater consistency of sleep midpoint ($\beta = -.41, p = .021$) was the only significant variable found in predicting higher cumulative GPA.

Table 4
Predicting Cumulative GPA in Mixed Work Students

	<i>B</i>	<i>SE</i>	β	<i>R</i> ²
Model 3 Combination				.010
Standardized Test Scores	-.223	.214	.197	
Gender	-.223	.214	-.274	
Race/Ethnicity	-.223	.214	.038	
SES	-.223	.214	-.138	
TST	.062	.284	.038	
IIV of TST	-.327	.218	-.264	
Midpoint	-.054	.228	-.040	
IIV of Midpoint	-.485	.199	-.407*	
SE	-.019	.381	-.016	
IIV of SE	-.143	.232	-.204	

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Discussion

The findings show that unemployed students reported the highest cumulative GPA. Gender was a significant predictor of GPA in this group; specifically, females typically reported better GPA's than their male counterparts. Higher standardized test scores also showed to be a predictor of better academic performance in unemployed college students. Further, an increase in consistency of TST and sleep midpoint were found to be predictors of higher GPA. This suggests that having a more fixed length of sleep and sleep/wake time predicts better academic performance. Students that worked during the day reported the lowest SES. Additionally, student's cumulative GPA was predicted based on their standardized test performance. Similarly, to the unemployed participants, findings for this group suggest that more consistent quantity and time of sleep predicts higher GPA. This finding was also found in the shift-working group. For students who worked a combination of daytime and shift work, sleep midpoint was the only

predictive variable; consistent sleep/wake times predicted higher GPA's. The combination work type group reported the lowest cumulative GPA and highest SES. Since sleep variables were the only predictors in the shift and combination work type groups, the findings suggest that sleep has a unique effect on GPA in people who work non-traditional hours.

The results partially supported the study hypotheses. The first part of the prediction stated that students with lower parental SES are more likely to work shift work than students with higher parental SES. However, the findings show that students who worked a combination of daytime and shift work had the highest reported SES, while the lowest reported SES was from the daytime work type group. The second part of the prediction stated that students with shift work schedules would have worse academic performance and poorer sleep than non-working college students and non-shift work student workers. Findings indicated that the combination work type group reported the lowest cumulative GPA, which partially matches the hypothesis as they did complete shift work. Additionally, the shift work group had the second lowest reported GPA, meaning that the participants who completed some degree of shift work had lower cumulative GPA's than those who did not have any shift work in their schedules.

The unemployed work type group was the only group where demographics (i.e., gender) were found to be a significant predictor. This could be due to the group size, as most students reported they were unemployed. Additionally, it is expected that the unemployed students have more time for involvement in university studies, which may explain their higher cumulative GPA's (Walpole, 2003). Further, the combination work type group was the only group where TST was not significant; however, this may also be due to group size as there were only 46 students categorized as combination, resulting in very low power. The negative relationship between consistency of sleep midpoint and cumulative GPA increased in each group in the order

of: unemployed, day, shift, combination. This indicates that the relationship between increasing consistency of sleep midpoint and decreasing cumulative GPA gets stronger with each group; unemployed students showed the weakest relationship between the variables, while combination work type group has the strongest. This relationship may be due to changes in timing of sleep but not length of sleep (see Tables 1-4). Further, it was expected that TST, sleep midpoint, and SE would be significant predictors of cumulative GPA (Arbabi et al., 2015; Hysing et al., 2016; Randler & Frech, 2006; Taylor et al., 2013); this study found that TST and sleep midpoint were more significant than SE as predictors. The lack of SE significance may be due to non-clinical levels of sleep disturbances. Additionally, TST and sleep midpoint for a single night was found to be less important than the consistency of both sleep variables over a longer period of time (Horowitz et al., 2001).

Limitations

This study had several limitations that should be addressed in future research. First, this study used students from a single university, which limits the generalizability of the data. There were also major differences in group sizes, which could have affected the results, due to lack of power and spurious results in the smaller groups. Further, SES was used as a proxy for parental support, and this may not have been accurate for each student. Moreover, sleep diaries are considered to be gold standard subjective measures for sleep, but findings from Aili et al. (2017) indicate that objective measures (e.g., actigraphy) and sleep diaries measure different aspects of sleep. Lastly, since paper sleep diaries were used, participants may have provided retrospective data by filling out the sleep diary at the end of the week rather than daily; this would negatively affect the validity of the results.

Future Directions

In the future, investigators should work towards obtaining more than one sample to increase generalizability and include questions regarding current parental financial support and scholarships in the investigator-designed questionnaire. The inclusion of questions on parental support and scholarships would help obtain a more accurate depiction of the student's financial need in college. Further, researchers should continue to assess IIV over longer periods of time, as this study assessed IIV only over a 7-day period. This will allow for a more in-depth investigation regarding the significance of consistency of sleep in comparison to a single night's. Additionally, the use objective measures of sleep (e.g., actigraphy, polysomnography) will increase the validity of quantitative measures, as the participants will not be self-reporting. Moreover, the use of a digital program for sleep diaries will help with data collection; it can help keep participants accountable and ensure they complete the sleep diary daily.

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Appendix

Demographic/Lifestyle Investigator-Designed Questionnaire

Gender: Male / Female	Ethnicity: White, (Not of Hispanic origin) _____
Age: _____	African American/ Black _____
Height: _____ ft _____ in	Asian/Pacific Islander _____
Weight: _____ lbs	Hispanic _____
Number of Children: _____	Native American _____
Marital Status: Married/Single/Divorced/ Separated/Widowed	Other _____

What is your Current Academic Rank (e.g., College Sophomore)? _____

	K-12												Post-high school							
Your Highest Education Level (yrs):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mother's Highest Education Level (yrs):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Father's Highest Education Level (yrs):	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mother's Career _____																				
Father's Career _____																				

Best estimate of your parents' *combined* income last year?

(1) Less than \$25,000	_____
(2) \$25,000-39,999	_____
(3) \$40,000-59,999	_____
(4) \$60,000-79,999	_____
(5) \$80,000-99,999	_____
(6) \$100,000-149,999	_____
(7) \$150,000-199,999	_____
(8) \$200,000 or more	_____
(9) REFUSED	_____
(10) DON'T KNOW	_____

EMPLOYMENT STATUS (check one):	WORK SCHEDULE (check one):
____ Full Time	____ Daytime Work
____ Part Time (Hours/Week) _____	____ Night Work
____ Retired	____ Rotating Shift (describe): _____
____ Unemployed	

Sleep Diary

Complete Before Bedtime:		Example						
Date		11/6/2006						
Day of Week		Mon						
How did you feel during the day? (1= Very Tired, 10=Rested/Alert)		9						
How long did you nap for?		120 min						
Complete in the morning:								
Last night I took _ mg of _ medication as a sleep aid.		5mg, Ambien						
How many alcoholic beverages did you drink as a sleep aid last night?		3						
What Stimulants did you take yesterday?		10mg, Ritalin 4 cups coffee						
What time did you get into bed last night?		9:30 pm						
How many minutes did it take to fall asleep last night?		30						
After you fell asleep the first time, how many times did you wake up in the <i>middle of the night</i> last night?		3						
After you fell asleep the first time, how many minutes were you awake in the <i>middle of the night</i> last night?		45						
How long did you lay awake in bed before you finally got out this morning? (do not count as <i>middle of the night</i> wake time)		45 min						
What time did you finally get out of bed this morning?		6:15 am						
How long do you estimate that you <u>actually slept</u> last night?		7 hrs 30 min						
How did you feel when you woke up this morning? (1= Very Tired, 10=Rested/Alert)		3						
Overall, what was the quality of your sleep last night? (1 = Light, 10 = Deep)		2						