

# **Wake Up or Stay Up?: The Correlation of Sleep Quality and Task Workload to Academic Performance of UST Graduate and Undergraduate Students During the COVID-19 Pandemic**

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## **Abstract**

Sleep deprivation is noted as one of the prevalent causes of disrupted circadian rhythms, especially to students and young adults. In a local perspective, around 46% of Filipinos do not get adequate sleep, and 32% stated that they get less than six hours of sleep per day (National Nutrition Council 2021). A survey from Sleep Cycle found out that Filipinos spent between 6 hours and 30 minutes and 6 hours and 45 minutes of sleep on average. This study discussed how the sleep quality and task workload of undergraduate and graduate students taking up different courses offered by the University of Santo Tomas affected their academic performance during the COVID-19 pandemic. The study measured the seven components of sleep quality using the Pittsburgh Sleep Quality Index (PSQI), the five components of task workload through the NASA Task Load Index (NASA-TLX), and the age, gender, and year level of the respondents. The academic performance of the respondents was measured through their General Weighted Average (GWA) for two academic years. The correlation among the variables was then determined using the multiple linear regression analysis. After thorough analysis of the results, it was concluded that age was a significant factor that affected the academic performance of graduate and undergraduate students.

## **Keywords**

Sleep Quality, PSQI, Task Workload, NASA-TLX, Academic Performance

## **1. Introduction**

The 2016 Healthy Living Index Survey, as cited by the National Nutrition Council (2021), found that 46% of Filipinos do not get adequate sleep, and 32% stated that they get less than six hours of sleep per day. Moreover, sleep deprivation affects a person's performance and health, specifically blood pressure and reaction time (Patrick et al. 2017). According to Sleep Cycle's recent survey, an application that monitors people's hours of sleep, Filipinos were spending 6 hours and 30 minutes to 6 hours and 45 minutes of sleep per day. (PH Ranks 4th in Sleep Deprivation in the World – Survey 2019). This study's aim was to lessen sleep deprivation cases in the Philippines by contributing to the sleep studies available in the country. The Philippines ranked the 4th spot and other countries experiencing sleep deprivation based on a recent study conducted by Sleep Cycle. In addition, the study aims to be a channel that experts can use to understand the circadian rhythm of college students here in the country and lessen the amount of sleep deprivation

cases. The findings of this study are highly significant for UST graduate and undergraduate students who are currently attending online classes at the university during the pandemic. The data gathered will serve as a foundation for discovering a correlation among sleep quality, task workload, demographics and academic performance. This would help students be aware of their sleep quality by providing them recommendations such as improving their sleeping habits and lifestyle.

### **1.1 Objectives**

The main objective of the study was to determine and analyze the correlation between sleep quality, task workload, demographics, and academic performance of UST graduate and undergraduate students during the pandemic.

- To measure the seven components of sleep quality of UST graduate and undergraduate students during the pandemic using the PSQI.
- To measure the five components of task workload of UST graduate and undergraduate students during the pandemic using the National Aeronautics and Space Administration Task Load Index (NASA-TLX). T
- o correlate PSQI, NASA-TLX, and demographic results of graduate and undergraduate students with their academic performance using their GWA.

## **2. Literature Review**

**Sleep.** Senior Sleep Physiologist from a hospital in the United Kingdom, Amy Gallagher, stated eight benefits of a good night's sleep. The first benefit is that it improves attention and concentration; this affects the attention span of the person, strategic thinking, assessment of risk, and reaction times. The second benefit is to be able to learn and make memories. The third benefit is that it helps maintain a healthy weight; not sleeping correctly will affect overeating and choosing foods that are high in calories later in the day. The fourth benefit is keeping the heart-healthy, as heart rate and blood pressure naturally drop, allowing the heart to rest and recover. The fifth benefit is keeping the immune system strong; it gives the body the time to rest and repair. The sixth benefit is it helps with emotional and mental wellbeing; not being able to sleep only adds to the list of worries the following day that may lead to depression or anxiety. The seventh benefit is it reduces stress levels; a good night's sleep can have an 'antistress' effect and relax the systems in your body that are responsible for this stress response. The last benefit is it helps maintain good relationships, as getting enough sleep can help one regulate their emotions, interact well with others, and maintain good interpersonal relationships. The benefits stated can be a basis for whether the student can get enough sleep despite the changes in the learning setup and environment.

**Task Workload.** Many teenagers have problems getting enough sleep. Short sleep is related to decreased cognitive function, academic accomplishment, and poorer physical and mental health. Biological and social factors can cause inadequate sleep in adolescents. Later bedtimes and less sleep are caused by a delay in circadian rhythms, a slower buildup of homeostatic sleep pressure, and less parental supervision of adolescents' sleep habits (Chee et al. 2020). Also, as stated in the Associations Between Mental Workload and Sleep Quality in a Sample of Young Adults Recruited from a US College Town, poor sleep among university students is a significant public health concern, with an alarming 70% reporting sleeping less than 7 hours per day and 60% passing the criterion for poor quality sleep. Furthermore, young adults have a delayed circadian rhythm compared to children and adults, which supports later bed and rising hours. Poor quality of sleep can also be observed in this COVID-19 pandemic.

The learning method previously conducted in the classroom is temporarily suspended in favor of an online learning approach undertaken at home, as stated in the study of Fathimahhayati and Gunawan. This significant change in learning methods will impact students' mental health, especially for those not acclimated to online learning methods. A NASA-TLX questionnaire was utilized to assess cognitive workload, and a PSQI (Pittsburgh Sleep Quality Index) questionnaire was employed to evaluate sleep quality. The respondents are 209 Mulawarman University Industrial Engineering students. According to the findings, 58.8% of pupils had a high mental workload, 26.3 % had a medium mental workload, 12.9 % had a very high mental workload, and the rest had a shallow mental effort. Meanwhile, most kids were sleeping poorly. Recent studies concluded that adolescents who spent more time on homework/studying spent less time on sleep, media use, and social activities in a competitive academic context.

**Economic Implications.** The economic implication of the study is defined by the response of an economy to an initial change or the direct effect that occurs through re-spending income received by a component of value added. According to the National Library of Medicine, their study examines the economic burden of insufficient sleep across five different Organization for Economic Co-operation and Development (OECD) countries. To do that, the researchers

aim to encourage dialogues on the economic burden of insufficient sleep by providing to the evidence base surrounding this public health problem. The research findings provide to the subsisting evidence base in four different areas: (1) factors associated with insufficient sleep; (2) link between insufficient sleep and (all cause)-mortality; (3) association between insufficient sleep and workplace productivity; (4) economics costs of insufficient sleep across five different OECD countries. Inadequate sleep is a substantial public health problem regularly affecting more than one in three adults. Although partly related to clinical sleep disorders and other health complaints, much appears to be due to work or lifestyle related sleep restriction. Health, well-being, productivity, and safety suffer. Besides their human cost, these consequences have an economic cost which the present study demonstrates is very substantial. The importance of such an analysis is that political and administrative decisions are largely based on economic data. As there is strong competition for health and preventive health funds, sleep health advocates must establish how inadequate sleep ranks alongside other health and social problems in terms of societal and financial cost and associated communal illness and injury burden (Hillman 2018). In conclusion, both articles relate to economic implications of insufficient sleep which is in connection to the study of the researchers which is the circadian rhythm of college students before and during the COVID-19 Pandemic.

**Trending Remedies.** Since the existence of sleep deprivation, various sleep studies have been conducted by numerous researchers and scientists around the world. Consequently, numerous recommendations, remedies, and drugs have been fabricated to address the issue of inadequate sleep. One study found that naps are beneficial in helping to reduce students' sleep debts (Wise 2018). The study helped universities realize the importance of naps, especially to university students. With this, libraries were found to be the ideal location for 'nap stations' because libraries are often the infrastructures that are opened the longest. Another trending remedy is the use of melatonin supplementation. Melatonin is a body hormone that regulates the body's sleep-wake cycle.

Moreover, melatonin supplements are beneficial in modulating the circadian components of the sleep-wake cycle and improving sleep efficiency (Paryab et al. 2018). In addition, Cheikh (2018), as cited by Paryab et al. stated that when melatonin is ingested before bedtime, it increases sleep duration, decreases nighttime awakenings, reduces nocturnal activity, and assists with sleep advancement. A study by Fatemeh et al. (2021) also found that melatonin supplementation proved a significant improvement in sleep quality as assessed by the Pittsburgh Sleep Quality Index (PSQI). Introducing small changes to one's daily routine such as a 20-to-30-minute exercise 5 to 6 hours before bedtime may make a person more likely to fall asleep (Cedars Sinai, n.d.). Reducing daytime naps to 20 minutes or less per day may increase chances of sleeping better at night (National Nutrition Council 2021). Avoiding substances such as caffeine, nicotine, and alcohol may also help prevent further sleep deprivation as these substances disrupt sleep. To date, no local studies have been conducted that have addressed the prevalence of sleep deprivation amongst UST graduate and undergraduate students.

### 3. Methods

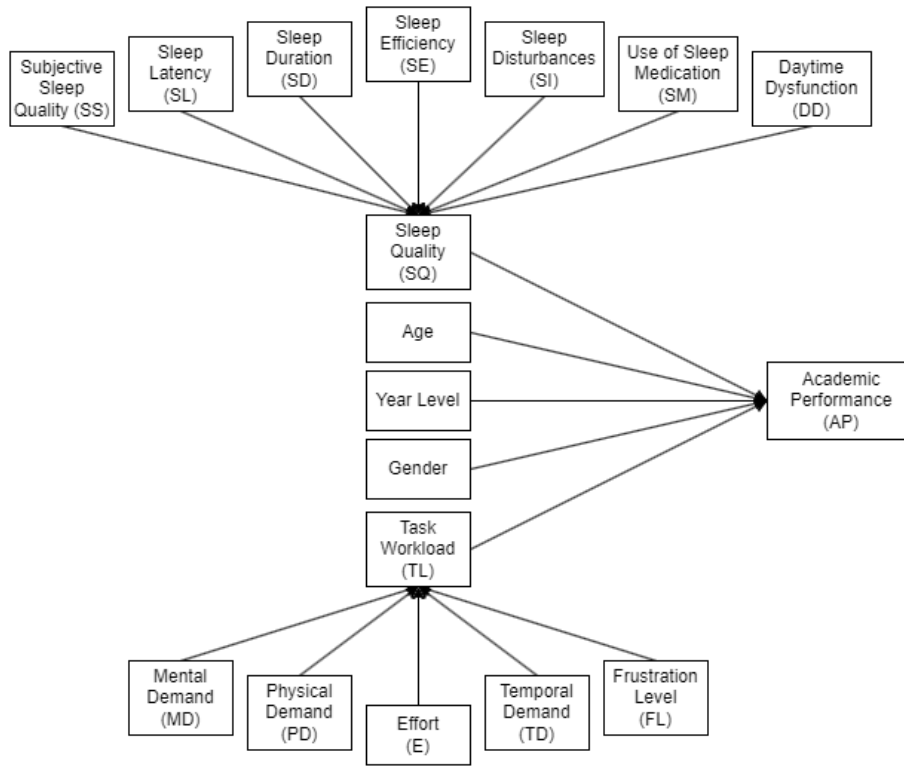


Figure 1. Overview of the Conceptual Framework for Undergraduate Students

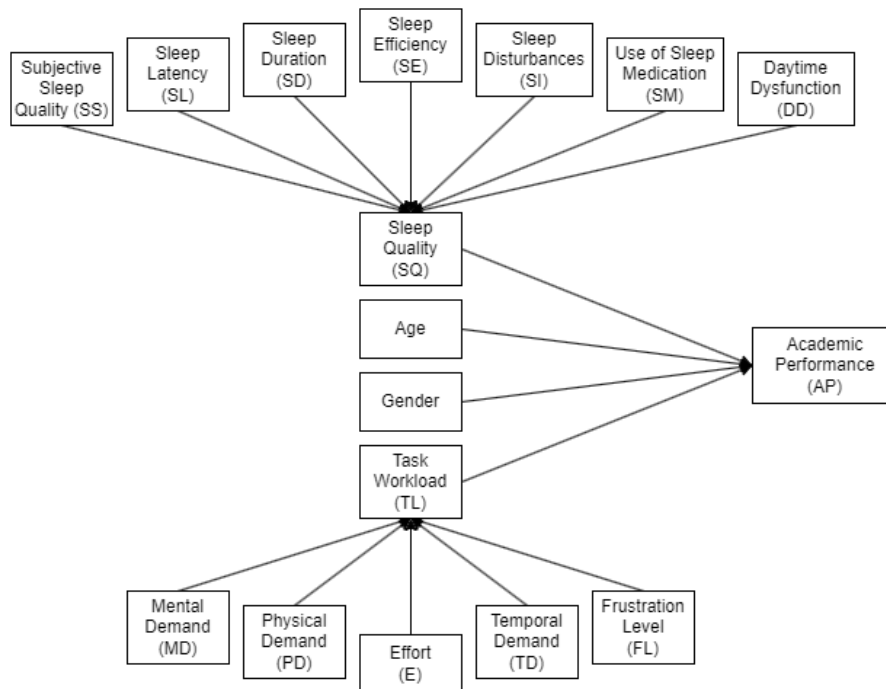


Figure 2. Overview of the Conceptual Framework for Graduate Students

**Research Design.** The researchers developed the conceptual framework, as seen in Figure 1 and Figure 2, to represent the sets of concepts and relationships that express the elements of the study. The independent variables that were used in the study are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, daytime dysfunction, mental demand, physical demand, temporal demand, effort, frustration level, age, year level, and gender. Whereas the dependent variable was the academic performance of the UST students. The results of the PSQI, NASA-TLX, and GPA were used to determine the correlations between these variables. Once the data were gathered, it was also tested for its compliance with the assumptions for multiple regression which were the Homogeneity of Variance (Homoscedasticity), Independence of Observations, Normality, and Linearity. To determine whether there is a relationship, the researchers tested the correlation of the fifteen independent variables (SS, SL, SD, SE, SI, SM, DD, MD, PD, TD, E, FL, A, YL, G) with AP, being the dependent variable, using Multiple Linear Regression.

#### 4. Data Collection

**Subjects and Study Site.** The respondents that participated in the study were 2nd year, 3rd year, 4th year, and graduate students that were currently enrolled in the University of Santo Tomas. The respondents were then profiled by their Age, Program, and Year Level. These were the chosen respondents for the study since the main objective of the paper is to determine the academic performance and task workload of the students. In addition to this, only the 2nd, 3rd, 4th year, and graduate students were the chosen respondents since they were the year levels that were able to experience at least two years of online classes in UST during the pandemic. To determine the sample size of the study, the researchers used Cochran’s Formula, with a 95% confidence level and a level of acceptable error of 5% to make up for the possible inaccuracy from the respondents’ data since some of their responses relied on their memory. The standard deviation that was used in the study was 0.5. The final computed sample size was 385 respondents.

**Data Gathering Procedure.** To gather the needed data for the study, the researchers made use of a questionnaire that was placed in a Google Forms document. The questionnaire was composed of profiling questions, as well as the combined questions from PSQI and NASA-TLX. This survey was deployed through different social media platforms such as Facebook and through the students’ e-mails. In addition, the researchers also conducted the survey in-campus.

**Mode of Data Analysis.** The study utilized the tool multiple linear regression for the analysis of the variables. Multiple linear regression, also known simply as multiple regression, is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. Multiple linear regression, also known as multiple regression, is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. Multiple regression is an extension of linear regression that uses just one explanatory variable. The software that was used to run the multiple regression was the International Business Machines Statistical Package for Social Sciences Analysis of a moment structures (IBM SPSS Amos). This is a powerful software that helps support research and theories by extending standard multivariate analysis methods, which includes regression, factor analysis, correlation, and analysis of variance. This tool and this software helped the researchers analyze the correlation between sleep quality, task workload, and academic performance, of UST students during the pandemic.

### 5. Results and Discussion

#### 5.1 Numerical Results

Table 1. PSQI Scores of Undergraduate Students

PSQI Scores of Undergraduate Students							
Score	SS	SL	SE	SD	SI	SM	DD
0	13	41	204	65	6	0	22
1	153	112	60	63	176	22	79
2	115	114	25	133	129	28	131
3	41	55	33	61	11	63	90

Table 1 shows the PSQI scores of UST undergraduate students. It is composed of 7 components namely subjective sleep quality (SS), sleep latency (SL), habitual sleep efficiency (SE), sleep duration (SD), sleep disturbances (SI), sleep medication (SM), and daytime dysfunction (DD). SS assesses the individual's perception of their sleep quality, including the ability to fall asleep and stay asleep. 1 is the most answered by the respondents which accounted for 153

of the responses. SL measures the length of time it takes for the individual to fall asleep after going to bed. 2 was the most answered by the respondents which accounted for 114 of the responses. SE calculates the percentage of time spent asleep while in bed. The most common response was 0 which accounted for 204 responses. SD assesses the total amount of time the individual spends sleeping. The most common response, which accounted for 133 of the responses, was 2. SI assesses the frequency and severity of various sleep disturbances, such as difficulty breathing, snoring, and leg movements. The most common response, which accounted for 176 of the responses, was 1. The use of sleep medication assesses the use of sleeping medications and their effectiveness. The most common response, which accounted for 63 of the responses, was 3. Lastly, DD assesses the impact of poor sleep on the individual's daily functioning, including difficulty with concentration, memory, and physical and mental performance. The most common response, which accounted for 131 of the responses, was 2.

Table 2. PSQI Scores of Graduate Students

PSQI Scores of Graduate Students							
Score	SS	SL	SE	SD	SI	SM	DD
0	2	5	21	4	0	25	4
1	13	8	4	5	19	2	6
2	11	10	0	9	8	0	10
3	1	4	2	9	0	0	7

Table 2 shows the PSQI scores of UST graduate students. SS assesses the individual's perception of their sleep quality, including the ability to fall asleep and stay asleep. 1 is the most answered by the respondents which accounted for 13 of the responses. SL measures the length of time it takes for the individual to fall asleep after going to bed. 2 was the most answered by the respondents which accounted for 10 of the responses. SE calculates the percentage of time spent asleep while in bed. The most common response was 0 which accounted for 21 responses. SD assesses the total amount of time the individual spends sleeping. The most common response, which accounted each for 9 of the responses, was 2 and 3. SI assesses the frequency and severity of various sleep disturbances, such as difficulty breathing, snoring, and leg movements. The most common response, which accounted for 19 of the responses, was 1. The use of sleep medication assesses the use of sleeping medications and their effectiveness. The most common response, which accounted for 25 of the responses, was 0. Lastly, DD assesses the impact of poor sleep on the individual's daily functioning, including difficulty with concentration, memory, and physical and mental performance. The most common response, which accounted for 7 of the responses, was 3.

Table 3. NASA-TLX Scores of Undergraduate Students

NASA-TLX Scores of Undergraduate Students					
Score	MD	PD	E	TD	FL
1	0	3	0	0	1
2	0	8	2	0	5
3	3	32	10	4	18
4	15	52	37	24	43
5	42	93	86	89	80
6	115	59	94	118	70
7	147	75	93	87	105

Table 3 shows the NASA-TLX scores of UST undergraduate students. The table is composed of 5 components namely mental demand (MD), physical demand (PD), effort (E), temporal demand (TD), and frustration level (FL). MD assesses the cognitive demands of the task, including the need to concentrate and remember information. This was most rated as 7 by the respondents which accounted for 147 of the responses. PD measures the physical demands of the task, including the amount of physical effort required. This was most rated as 5 by the respondents which accounted for 93 of the responses. E assesses the physical and mental effort required to complete the task. This was most rated as 6 by the respondents which accounted for 94 of the responses. TD assesses the time pressure of the task, including the need to work quickly or under time constraints. This was most rated as 6 by the respondents which accounted for 118 of the responses. Lastly, FL measures the level of frustration or stress experienced while performing the task. This was most rated as 7 by the respondents which accounted for 105 of the responses.

Table 4. NASA-TLX Scores of Graduate Students

NASA-TLX Scores of Graduate Students					
Score	MD	PD	E	TD	FL
1	0	1	0	0	0
2	0	1	0	0	3
3	1	0	1	0	2
4	1	7	6	1	6
5	2	11	5	8	6
6	9	5	6	9	3
7	14	2	9	9	7

Table 4 shows the NASA-TLX scores of UST graduate students. MD assesses the cognitive demands of the task, including the need to concentrate and remember information. This was most rated as 7 by the respondents which accounted for 14 of the responses. PD measures the physical demands of the task, including the amount of physical effort required. This was most rated as 5 by the respondents which accounted for 11 of the responses. E assesses the physical and mental effort required to complete the task. This was most rated as 7 by the respondents which accounted for 9 of the responses. TD assesses the time pressure of the task, including the need to work quickly or under time constraints. This was most rated as 6 and 7 by the respondents which each accounted for 9 of the responses. Lastly, FL measures the level of frustration or stress experienced while performing the task. This was most rated as 7 by the respondents which accounted for 7 of the responses.

Table 5. Significance Values from SPSS (Undergraduate Students)

Variable	P-value	Conclusion
<b>Sleep Quality</b>		
Subjective Sleep Quality	0.687	Accept Null Hypothesis
Sleep Latency	0.256	Accept Null Hypothesis
Sleep Duration	0.553	Accept Null Hypothesis
Habitual Sleep Efficiency	0.131	Accept Null Hypothesis
Sleep Disturbances	0.233	Accept Null Hypothesis
Use of Sleeping Medication	0.231	Accept Null Hypothesis
Daytime Dysfunction	0.888	Accept Null Hypothesis
<b>Task Workload</b>		
Mental Demand	0.528	Accept Null Hypothesis
Physical Demand	0.803	Accept Null Hypothesis
Temporal Demand	0.185	Accept Null Hypothesis
Effort	0.070	Accept Null Hypothesis
Frustration Level	0.320	Accept Null Hypothesis
<b>Demographics</b>		
Age	0.000	Accept Alternative Hypothesis
Gender	0.115	Accept Null Hypothesis
Year Level	0.940	Accept Null Hypothesis

Table 6. Significance Values from SPSS (Graduate Students)

Variable	P-value	Conclusion
<b>Sleep Quality</b>		
Subjective Sleep Quality	0.271	Accept Null Hypothesis
Sleep Latency	0.368	Accept Null Hypothesis
Sleep Duration	0.399	Accept Null Hypothesis
Habitual Sleep Efficiency	0.768	Accept Null Hypothesis
Sleep Disturbances	0.800	Accept Null Hypothesis

Use of Sleeping Medication	0.936	Accept Null Hypothesis
Daytime Dysfunction	0.352	Accept Null Hypothesis
<b>Task Workload</b>		
Mental Demand	0.696	Accept Null Hypothesis
Physical Demand	0.151	Accept Null Hypothesis
Temporal Demand	0.093	Accept Null Hypothesis
Effort	0.884	Accept Null Hypothesis
Frustration Level	0.903	Accept Null Hypothesis
<b>Demographics</b>		
Age	0.007	Accept Alternative Hypothesis
Gender	0.844	Accept Null Hypothesis

Though the statistical analysis of the study yielded no significant relationships among the sleep quality and task workload variables with the dependent variable, the study was able to discover the conditions of UST students in terms of their academic performance, sleep quality, and task workload during the COVID-19 pandemic. The 349 respondents of the study had a mean GWA of 1.686 which is considered to be above average in the standards of the university given that a student who has a GWA greater than or equal to 1.750 is eligible for Latin Honors. While the academic performance of students during the pandemic was found to be applaudable, it should be kept in mind the numerous possible factors that may affect this. Students now have more accessibility to learning resources since class recordings and presentations are directly sent to them. Moreover, fatigue caused by commuting/traveling to and from the university was eliminated due to online classes. Furthermore, students had the lack or had inadequate supervision from professors. With this, inadequate supervision may result in different scenarios, such as the possibility of students engaging in various forms of academic dishonesty and students feeling like they are not learning enough from online classes.

In relation to the sleep quality of the respondents, they had a mean PSQI score of 9.45 which is considered to be very high. It is recommended that people who scored 5 or higher to consult with healthcare professionals regarding their sleep quality. In addition, as for the task workload of students, the respondents had a mean NASA-TLX score of 81.03 which is very high.

Table 7. Linear Regression Results for Undergraduate Students

<b>Coefficients</b>						
Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	1.015	0.066		15.445	0.000
	Age	- 0.12	0.003	- 0.195	- 3.540	0.000
a. Dependent Variable: GWA_INV						

As for the relationship between age and the academic performance of undergraduate students, it was found to be negatively correlated as indicated by the Unstandardized B value in Table 7. This indicates that as the age of the undergraduate students increases, their academic performance decreases, and vice versa.

Table 8. Linear Regression Results for Graduate Students

<b>Coefficients</b>						
Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients	t	Sig.
1	(Constant)	0.237	0.177		1.337	0.193
	Age	0.021	0.007	0.508	2.949	0.007
a. Dependent Variable: GWA_INV						



On the other hand, the relationship between age and the academic performance of graduate students was found to have a positive correlation as seen in the Unstandardized B value in Table 8. This indicates that the academic performance of graduate students increases as they age.

## 6. Conclusion

To conclude, academic performance is not affected by a student's sleep quality and task workload, but is however, affected by age. The results achieved the main objective of the study, which was to determine the correlation among the aforementioned variables. In addition to this objective, the study was able to discover the conditions of students in terms of their academic performance, sleep quality, and task workload.

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## **Biography**

**Raymond Izaac M. Casaclang** is a dedicated student currently holding the position of Vice President for Finance and Sponsorship in the Operations Research Society of the Philippines - UST Chapter. He has gained valuable operations and data analytics experiences through internships at Universal Robina Corporation and Manila Water Philippine Ventures.

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**Niccolo Maurice N. Villaflor** is currently the Vice President for Audit and Logistics in the Operations Research Society of the Philippines - UST Chapter. He has gained valuable marketing and logistics experiences through internships at Herschel Supply Company PH and Samsung Electronics.

Together, this group of fourth year BS Industrial Engineering students has a wealth of experience and skills that has served them well in their endeavors and will serve them even better in future endeavors to come.