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Multivariate Regression Analysis of Sleep Deprivation Through Academic Performance of Architecture Students

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Abstract

This paper addresses a study on architecture students regarding the effect of sleep quality and various factors that affect their academic performance. The study was inspired by the lack of analysis done on architecture students regarding their sleep quality, which significantly affects their performance in school. The lack of sleep or poor sleep quality also affects the person's ability to function correctly. Quantitative methods, which utilized multivariate regression analysis to test the relationship between the two variables and numerous factors, were utilized in this study. Surveys were also distributed to gather data. The study had a sample size 221 from a population size of 2,128 recently enrolled architecture students. The Pearson Correlation Coefficient was utilized using IBM SPSS (Statistical Package for the Social Sciences) Statistics, a software package to determine the relationship between sleep deprivation and students' academic performance. The study measured the seven components of sleep quality using the Pittsburgh Sleep Quality Index (PSQI). The research findings show that all the respondents had poor sleep quality. The study on the relationship between sleep quality and academic performance of architecture students indicates a weak yet discernible correlation between their GPA and critical factors like sleep quality, number of units, schedule, and year level. The strength of these correlations indicates that there may be additional factors besides those examined in this study that significantly impact the students' academic performance. However, the links discovered are statistically significant. Two variables—year level and number of units—showed a substantial link with sleep quality when assessed for their correlation strength. However, sleep quality had a very weak correlation with academic performance.

Keywords
Sleep Quality, Architecture Students, Grade Point Average, Academic Performance, Pearson Correlation Coefficient.

1. Introduction
Sleep is an essential daily activity for humans since it is the part where people recover their energy after an exhausting day. Not having enough sleep can cause many health problems and diseases, which the right amount of sleep can prevent. Acquiring adequate and quality sleep on a regular basis can greatly enhance your brain function, mood, and overall health. Conversely, insufficient sleep can increase your chances of developing various diseases and disorders, such as heart disease, stroke, obesity, and dementia. Adopting a growth mindset can inspire you to come up with creative and innovative solutions. (Wein, 2021). College students have a heavier academic workload as they pursue a specialized field based on their interests and skills. The heaviness of the academic workload mostly depends on the program that the students are studying, implying that other programs have much more workload than some programs. According to the National Survey of Student Engagement conducted by Indiana University, architecture students typically have the highest workload among all university degrees. The survey found that these students spend an

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average of 22.2 hours per week on work outside of class time, which is more than the second-highest workload of engineering and science-based subjects, who spend less than 20 hours per week. In my personal experience, this figure seems to be a modest estimation. (Chown., 2018). Academic workload is a factor that primarily affects a student's ability to perform well in school. The time spent doing academic requirements can make students feel overwhelmed when they are given too many tasks. According to a study conducted by Omaima Mostafa Kamel at Cairo University, academic overload can negatively impact the academic adjustment of first-year university students. This means that students who feel burdened by their academic responsibilities may struggle to adjust to university life. (Kamel, 2018)

The correlation between sleep deprivation and grade point average (GPA) was determined by the study using random-effects and fixed-effects models. In order to investigate the link between sleep deprivation and college graduation rates, logistic regression was also used. The results show that chronic sleep deprivation lowers GPAs and reduces the likelihood of graduating. Senior year sleep deprivation has a bigger impact on graduation than freshman year sleep deprivation. (Chen, 2019).

1.1 Objectives

Numerous research studies have shown that sleep difficulties and sleep deprivation significantly impact students' health and academic performance. In this study, architecture students at a higher education institution in the Philippines will have their academic performance evaluated and put to the test in connection with sleep deprivation. The school and its students will benefit from understanding how these variables are related.

1. By determining the relationship between sleep deprivation and academic performance and identifying how much various factors affect sleep quality, mitigation strategies can be created to reduce the effects of the factors that affect sleep quality.
2. By determining how much various factors affect sleep quality and reducing the effects of these factors, the academic performance of architecture students can be significantly improved

2. Literature Review

Acquiring enough sleep time can benefit a student's academic functions. Based on the National Survey of Student Engagement, architecture students spend 23.7 more hours studying per week than chemical engineering, physics, and chemistry majors (considered the most challenging). Additionally, architecture students learn twice as much as journalism students (Capps., 2021). Recent studies indicate that sleep patterns significantly impact college students' academic achievement, accounting for more than 25%. Researchers have investigated the connection between sleep patterns and cognitive function for over a century. New research reveals that good sleep habits can enhance cognitive function, including better learning and memory (Lomholt., 2022). However, for architecture students who require more than 5 hours of sleep each night, sleep can be challenging. Lack of sleep can hinder their ability to succeed as designers (Chown., 2018).

The study conducted by Mnatzaganian et al. (2020) used a prospective cohort study that used 18 survey questions derived from the Pittsburgh sleep quality index (PSQI) to measure the factors associated with sleep deprivation, including demographics, individual sleep components, and factors affecting sleep quality. It is important for students to get an adequate amount of sleep to avoid sleep deprivation. Nunez (2023) explains that the severity of symptoms depends on how long one has gone without sleep, with more intense symptoms occurring after longer periods of sleep deprivation. Nunez's study outlines five stages of sleep deprivation, ranging from 24 to 94 hours, each with distinct symptoms. Lack of sleep can negatively impact social interactions, learning, driving, and work performance. It may cause difficulty paying attention, learning, and responding, as well as difficulty interpreting the emotions and reactions of others. Sleep deprivation can also lead to irritability, moodiness, and anxiety in social situations (What Are Sleep Deprivation and Deficiency? | NHLBI, NIH, 2022).

Inadequate sleep can negatively impact the academic performance of students, as highlighted by Perotta et al. (2021). Medical students experiencing sleep deprivation and daytime sleepiness are more likely to experience symptoms of depression and anxiety, affecting their quality of life and educational environment. Fortunately, effective strategies such as distributing academic duties, customized mentoring sessions, health promotion initiatives, and allocating time for study and leisure activities can enhance medical students' academic performance and quality of life. Similarly, research by Chen (2019) shows that lack of sleep significantly affects college students' academic success. The study used random-effects and fixed-effects models to establish a correlation between sleep deprivation and grade point average (GPA). It also utilized logistic regression to examine the relationship between sleep deprivation and

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graduation rates during college. Findings indicate that chronic sleep deprivation leads to lower GPAs and decreases the probability of graduating. Sleep deprivation during the senior year significantly impacts college graduation more than during freshman year.

A study conducted by Sygaco (2021) stated that sleep plays a crucial role in maintaining a balanced life by replenishing the energy expended during the day. However, when sleep is frequently interrupted or inadequate, it can negatively affect the health and productivity of teenagers. It is recommended that young adults get at least 8 to 10 hours of sleep daily. To investigate the relationship between sleep deprivation and academic performance, grade 12 students in Science, Technology, Engineering, Agriculture, and Mathematics (STEAM) from Silliman University Senior High School in the Philippines completed an online questionnaire. The students reported that they often have little time to sleep due to the demanding academic workload, with some being busy for almost eight hours after school. The top three consequences of sleep deprivation were exhaustion, fatigue, pessimism, health risks, and decreased cognitive function. Strategies to reduce sleep debt include managing time effectively, creating a comfortable sleeping environment, and limiting social media use. Surprisingly, the study found no significant correlation between sleep and academic performance. In addition, a survey conducted by Juan et al. (2018) from the Bulacan State University findings demonstrates that engineering students at Bulacan State University's Malolos Campus engage in poor sleep practices despite being aware of the negative impact that sleep deprivation has on their health and academic performance. Based on the study's findings, it is also possible to conclude that getting enough sleep is essential for students' academic success. As a result, students should develop a healthy sleep routine to improve their academic performance. Hasan et al. (2017) conducted a study that revealed that architecture students in Malaysia face challenges when completing their studio tasks assigned by their lecturers. This issue resulted in a decrease in academic performance. The study also identified internal and external emotional factors that often lead to students feeling "stuck" and unable to progress in their work. Additionally, the study found that inadequate sleep and irregular sleep schedules negatively affect architecture students' academic performance.

3. Methodology

The study utilized a quantitative research design to collect and analyze data. A quantitative design employs numerical data and statistical methods to identify any correlation between variables. The study's premise is that many sleep deprivation studies have been conducted on engineering students and medical courses. However, there needs to be more research on sleep deprivation experienced by architecture students. The study aims to examine the effects of sleep deprivation on architecture students due to their constant workloads, such as drafting plates.

The proponents used the Raosoft sample size calculator to establish the sample size required for the study's population. They will determine statistically significant differences by selecting a specific level of probability known as the "p-level" or α. This safeguards against incorrectly rejecting the null hypothesis through chance (Type I error). The sample size calculator yielded a sample size of 221 from a population size of 2128, confidence interval of 94, and a margin of error of 6. Most researchers conducting surveys consider a margin of error of 4% to 8% at the 95% confidence level to be acceptable. Sample size, population size, and percentage all have an impact on it. (Pollfish, nd) If there is no difference between groups, a p-level of $\alpha = 0.05$ is generally accepted, meaning there is a 95% probability of correctly rejecting the null hypothesis, as Page (2019) stated.

This study is limited to architecture students in their second year or higher. They are enrolled in the first semester of S.Y 2023-2024 at a higher education institution in the Philippines. The study sample size consists of 2,128 recently enrolled architecture students. The sample size calculator determined a sample size of 221 from a population size of 2,128, a confidence interval of 94, and a margin of error of 6.

4.DataCollection

A survey was conducted online to collect data from the Architecture students of a higher education institution in the Philippines respondents. The survey was created using Google Forms, and 221 individuals participated. The study utilized Raosoft to analyze the collected data, which assisted in validating the study's hypothesis and supporting its findings.

5. Results and Discussion

Based on Table 1 the variables that can affect their sleep, the Pittsburgh Sleep Quality Index (PSQI) score of the

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respondents is reflected in their survey answers, as shown in the table above. The score is an indicator of the sleep quality of the respondents and can give insight into their sleeping habits.

Table 1. PSQI Scores of Architecture Students

Score	**Overall Sleep Quality**	**Sleep Latency**	**Sleep Duration**	**Sleep Efficiency**	**Sleep Disturbance**	**Sleep Medication Use**	**Day Time Disturbance Due to Sleepiness**
0	5	3	19	20	0	152	5
1	45	24	40	8	37	15	9
2	61	137	70	9	92	20	75
3	110	57	92	184	92	34	132
Total	221	221	221	221	221	221	221

Survey Results

The Table 2 above displays the respondents' GPA range and the number of respondents in each range. According to the table, only 26 respondents have a GPA between 1.00 - and 1.50, the lowest number of respondents. On the other hand, the highest number of respondents, which is 84, have a GPA ranging from 1.51 - 2.00.

Table 2. GPA Score

Grade	Occurrence
1.00 - 1.50	26
1.50 - 2.00	84
2.00 - 2.50	71
2.50 - 3.00	40
Total	221

Table 3. Number of Units Score

Units Enrolled	Occurrence
14 - 17 units	14
18 - 21 units	54
22 - 25 units	105
26 - 28 units	48
Total	221

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The Table 3 above displays the number of students enrolled in different unit ranges, as reported by the respondents (221). Fourteen students enrolled in 14-17 units, 54 in 18-21 units, and 105 in 22-25 units, which is the highest number of occurrences. The remaining 48 respondents enrolled in 26-28 units.

Table 4. Class Days Schedule Score

Days	Occurrence
1- Once a week	1
2- Twice a week	2
3- Three Times a week	8
4- Four Times a week	17
5- Five Times a week	135
6- Six Times a week	58
Total	221

The Table 4 presented above displays the schedule of class days for the respondents. Based on the results, the majority of the respondents have a schedule of five days a week, which is 135 respondents. The second highest number of respondents, 58, have a schedule of six days a week.The weekly schedule in the table indicates the days respondents spend inside the school. Based on the results, it can be inferred that the respondents spend most of their time at the school.

Table 5. Class Time Schedule Score

Times	**Occurrence**
1 - Morning	5
2 - Morning to Afternoon	71
3 - Morning to Evening	102
4 - Afternoon	5
5 - Afternoon to Evening	38
6 - Evening	0
Total	221

The Table 5 displays the class schedule of the participants. Out of 221 respondents, only five have a morning schedule, while 71 have a morning to afternoon schedule. The morning-to-evening schedule is the highest occurrence, with 102 respondents having this schedule. Only five respondents have an afternoon schedule, and 38 have an afternoon to evening schedule. There were no respondents who had an evening schedule.

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Table 6. Demographic Score

Demographic	
Year Level	Occurrence
2nd Year	48
3rd Year	60
4th Year	94
5th Year	19
Total	221

According to the Table 6 displayed above, the respondents' demographics indicate the year level of each respondent. As per the table, 48 respondents identified as 4th-year students, the largest group. On the other hand, 60 respondents indicated that they belong to the 3rd-year level, which is the second highest number in the Table 6.

Table 7. Significant Values From SPSS

Variable	P - value	Conclusion
Sleep Quality		
Overall Sleep Quality	0.005	Reject Null Hypothesis
Sleep Latency	0.011	Accept Null Hypothesis
Sleep Duration	0.002	Reject Null Hypothesis
Sleep Efficiency	0.031	Accept Null Hypothesis
Sleep Disturbance	0.005	Reject Null Hypothesis
Sleep Medication Use	0.015	Accepted Null Hypothesis
Daytime Disturbance Due to Sleepiness	0.012	Accepted Null Hypothesis
Academic Performance		
GPA	0.001	Reject Null Hypothesis
Workload		
Number of Units	0.003	Reject Null Hypothesis
Schedule		

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Class Time Schedule	0.001	Reject Null Hypothesis
Class Days Schedule	0.004	Reject Null Hypothesis
Demographic		
Year Level	0.002	Reject Null Hypothesis

The Table 7 shows the hypothesis testing part in measuring the accuracy of the data gathered from the survey. The variable which concludes on rejecting the null hypothesis, has a p-value of less than 0.01, meaning that the data gathered from the survey is significant with the questionnaire responses.

Correlation of Variables

The Table 8 above shows students' graded percentage average(GPA) and their sleep quality, which is reflected in the result of PSQI, are correlated with each other. As the correlation is weak significance at 0.247 Pearson correlation coefficient.

Table 8. Correlation between GPA and PSQI

		Graded Percentage Average	PSQI
Graded Percentage Average	Pearson Correlation	1	.247*
	Sig. (2- tailed)		<.001
	N	221	221
PSQI	Pearson Correlation	.247**	1
	Sig. (2- tailed)	<.001	
	N	221	221

Table 9. Correlation between GPA and Number of Units

		Graded Percentage Average	Number of Units
Graded Percentage Average	Pearson Correlation	1	-.091
	Sig. (2- tailed)		.179
	N	221	221
Number of Units	Pearson Correlation	-.091	1
	Sig. (2- tailed)	.179	
	N	221	221

The Table 9 presented above displays a correlation analysis between the number of units taken by respondents and their corresponding graded percentage average (GPA). The results indicate that there is no significant

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relationship between the two variables. Pearson's correlation coefficient resulted in a negative value of -0.091, indicating a no negative relationship between the two variables. In other words, the number of units taken by the respondents has no significant impact on their GPA in the last semester.

Table 10. Correlation between GPA and Class Times Schedule

		Graded Percentage Average	Class Times Schedule
Graded Percentage Average	Pearson Correlation	1	.127
	Sig. (2- tailed)		.059
	N	221	221
PSQI	Pearson Correlation	.127	1
	Sig. (2- tailed)	.059	
	N	221	221

The Table 10 above shows the correlation between the GPA and the class schedule of the respondents. Based on the results, Pearson's correlation coefficient is 0.127, which signifies a weak correlation between the two variables.

Table 11. Correlation between GPA and Class Days Schedule

		Graded Percentage Average	Class Days Schedule
Graded Percentage Average	Pearson Correlation	1	-.085
	Sig. (2- tailed)		.209
	N	221	221
Class Days Schedule	Pearson Correlation	-.085	1
	Sig. (2- tailed)	.209	
	N	221	221

Based on the survey results, the Table 11 shows the correlation between students' GPAs and their class day schedules. Pearson's correlation coefficient value of -0.085 indicates a no relationship between the two variables. Therefore, the schedule of classes on a particular day does not significantly impact the student's GPA, as per the Pearson correlation.

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Table 12. Correlation between GPA and Year Level

		Graded Percentage Average	Year Level
Graded Percentage Average	Pearson Correlation	1	.062
	Sig. (2- tailed)		.360
	N	221	221
Year Level	Pearson Correlation	.062	1
	Sig. (2- tailed)	.360	
	N	221	221

The Table 12 displays the correlation between the GPA and year level of the students. Based on the results of the Pearson correlation, which is 0.062, there is a significantly weak correlation between the two variables. The correlation falls under the range of 0.01 to 0.30, which is classified as very weak.

Table 13. Correlation between PSQI and Year Level

		PSQI	Year Level
PSQI	Pearson Correlation	1	.251
	Sig. (2- tailed)		<.001
	N	221	221
Class Days Schedule	Pearson Correlation	.251	1
	Sig. (2- tailed)	<.001	
	N	221	221

The Table 13 displays respondents' year level and their sleep quality, as determined by the PSQI results. The data indicates a significant correlation between the two variables at a 0.01 level, which suggests that they have a notable impact on each other.

Table 14. Correlation between Number of Units and Year Level

		Number of Units	Year Level
Graded Percentage Average	Pearson Correlation	1	.034
	Sig. (2- tailed)		.309
	N	221	221
Class Days Schedule	Pearson Correlation	.034	1
	Sig. (2- tailed)	.309	
	N	221	221

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The Table 14 shows the correlation between the number of units and year levels as variables. As the Pearson correlation coefficient shows 0.034, the correlation between the two variables is weak.

Table 15. Hypothesis Analysis

Variable	P-Value	Conclusion
GPA		
Number of Units	0.279	Accept Null Hypothesis
PSQI	<.001	Reject Null Hypothesis
Class Time Schedule	0.059	Accept Null Hypothesis
Year Level	.36	Accept Null Hypothesis
Class Days Schedule	0.209	Accept Null Hypothesis
PSQI		
Year Level	<.001	Reject Null Hypothesis
Number of Units		
Year Level	0.309	Accepted Null Hypothesis

The Table 15 shows that all variables have a weak correlation to Academic performance (GPA) except the PSQI which is the only one that was determined to have a significant impact on the Academic performance (GPA). For the Sleep quality correlation both the year level and number of units have a correlation coefficient with the sleep quality, however the PSQI is the only one with that was determined to have a significant impact.

6. Conclusion

The study investigates the various factors that may impact the academic performance of architecture students. These factors include the quality of sleep, the number of units taken, the schedule, and the year level of the respondents. The proponents utilize Pearson's correlation coefficient to assess the degree of correlation between each variable. The correlation is determined based on the research model, which postulates the theoretical relationship between the variables. According to the research findings, all the respondents had poor sleep quality. The study on the academic performance of architecture students indicates a weak yet discernible correlation between their GPA and critical factors like sleep quality, number of units, schedule, and year level. While the observed relationships are statistically significant, the strength of these correlations suggests that there are factors beyond the ones investigated in this study that significantly affect the respondents' academic performance. Sleep quality had a very weak correlation to academic performance due to two variables - year level and number of units, which showed a significant association with sleep quality when tested for their correlation strength.

The study also suggests a weak correlation exists between the year level of architecture students and both sleep quality and the number of academic units they undertake. The connection between year level and number of units shows the workloads that each participant reflected on their sleep quality, which resulted in the respondents' academic performance. The weak correlation between sleep quality and GPA suggests that, while getting enough sleep can improve academic achievement, it is not the only factor. Similarly, the small correlations with the number of academic units and scheduling preferences suggest that these variables only significantly impact predicting GPA among architecture students. While there is some association between year level and academic achievement, it underscores the complex nature of academic success, with several elements impacting performance throughout a student's architecture education.

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Mart Lorenz R. Agravante is a fourth year student at a higher education institution in the Philippines currently pursuing Industrial Engineering. He is interested in improving his skills and knowledge in the field of continuous improvement. He is a member of the Organization of Industrial Engineering Students (ORIENTS).

Johanh Gabrielle C. Julian is a fourth year Industrial Engineering student at a higher education institution in the Philippines. Persistent and dedicated student in various fields which adapt collaborative and teamwork attitudes to have efficient and effective work processes which enhance the productivity of any team he's working on. Additionally, he is a driven student leader and team member. He is a former Music Guild Head of Organization of Industrial Engineering Students (ORIENTS) and a current Vice-President for External affairs of a higher education institution in the Philippines Choral Society

Miguel G. Tabirao is a fourth year Industrial Engineering student at a higher education institution in the Philippines, Quezon City. Striving to improve his skills, he continues to hone, acquire and utilize useful skills in order to become an effective industrial engineer. He is a member of the Organization of Industrial Engineering Students (ORIENTS).

Maricar M. Navarro has the prestigious title of ASEAN Engineer (AE) and is a Professional Industrial Engineer (PIE) recognized by the Philippine Institute of Industrial Engineers (PIIE). She is currently an Associate Professor and a Professor in the Graduate School Program at a higher education institution in the Philippines. Her areas of expertise are optimization of production processes, facility layout design, warehouse operations, and service delivery. Her area of interest is in financial optimization and decision-making in operations research, and she holds both a master's and a Ph.D in Industrial Engineering from Mapua University. As a committed member and Professional Industrial Engineer, Dr. Navarro actively contributes to the Philippine Institute of Industrial Engineers (PIIE).

Juan Miguel Dinglasan is a master's degree holder who worked in the school where he earned his bachelor's and trained as a student leader; had taught professional industrial engineering courses and had conducted training for various groups about research, statistics, methods engineering, feasibility study, and intellectual property, among others. He is keen on making complex things more straightforward and providing data-driven solutions for continual improvement. A lifelong learner, an empathic communicator, and a dynamic team player.

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