

# A Study of Relationship between Sleep Quality and Academic Performance

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## I. ABSTRACT

The objective of this research is to investigate and explore the relationship between sleep quality and academic performance of students in CUHK(SZ). Based on 91 received questionnaires of self-reported GPA and PSQI questions, our finding is that sleep quality has positive correlation with higher GPA and negative correlation with lower GPA. Among seven components in PSQI index system, subjective attitudes towards sleep quality are found to have most significant impact on self-reported GPA.

## II. INTRODUCTION

Reports in recent years indicate that high school and college students are facing a perceptible decrease on their average sleep qualities and sleep duration (Soong & Gau, 1995; Wolfson & Carskadon, 1998; Larberge, Petit, Simard, Vitaro, Tremblay & Montplaisir, 2001), and it can be verified by observations and interviews of self-behavior from students in CUHK(SZ). With physiological research showing that both sleep qualities and sleep duration are correlated with one's cognitive functions (Paavonen et al, 2010; Nebes, Buysse, Halligan, Houch & Monk, 2009), a reasonable hypothesis can be proposed that the effect of sleep qualities and sleep duration might also intermediately affect one's academic performance by affecting the cognitive functions.

A supporting report proposed by a study group from Netherlands claimed that, sleep qualities and sleep duration have slight but affect on students' academic performance (Dewald, Meijer, Oort, Kerkhof, & Bogels, 2010). Concluded from their report and previous reports they referred to, the common and unavoidable problem in the research is lack of appropriate approaches to measure the real academic performance of the respondents. Principally previous researchers applied self-reported GPA and parent-reported GPA in their research to represent the academic performance, which would explicitly cause publication bias while respondents concerning about the potential privacy leak. For purpose of hedging the subjective bias, even though in our research the adopted approach is still subject-reported GPA, cross-validation section was designed and performed. If the cross-validation can support the result based on subject-reported GPA, the impact of publication bias would be reduced.

Research principally focuses on the correlation between sleep qualities and academic performance, and therefore the questions to investigate are

- The relationship between sleep qualities and academic performance
- The respective relationship between academic performance and each factors of sleep qualities

## III. METHODOLOGIES

### A. Measurements of Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI) was used to scientifically and quantitatively measure the sleep qualities of respondents, which contains 19 self-rated questions. Questionnaire is divided into 7 components which represents distinct factors of sleep qualities. The score is added up to 21 (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

### B. Measurements of Academic Performance

1) *Self-reported GPA*: A questionnaire including PSQI questions and GPA information was posted online and published for 2 weeks.

2) *In-class evaluation in MAT2040 Lecture*: Since every two week there is an in-class evaluation in Linear Algebra lecture this semester, that students will be asked to answer one question relative to lecture and assignments. Under the permission of teaching stuffs questionnaires on PSQI were handed out and collected together with their submitted quiz. The objective of evolving in-class evaluation in the research is to cross-validate the conclusions inferred by the first method, which will eventually contribute to a stronger conclusion.

### C. Correlation Analysis

Statistical correlation analysis was applied in analyzing the collected data. The procedure of correlation analysis is to calculate the correlation coefficients of two variables, self-reported GPA and PSQI score, using the formula

$$\rho = \frac{E[(X - \mu_x)(Y - \mu_y)]}{\sigma_x \sigma_y}$$

The correlation is represented by the correlation coefficient  $\rho$ , which has a range of  $-1 \leq \rho \leq 1$ , where positive  $\rho$  indicates positive correlation and negative  $\rho$  indicates negative correlation. Closer the absolute value of  $\rho$  to 1 corresponds to a stronger correlation between two variables(Hogg, Tanis, & Zimmerman, 2010).

#### D. Participants

Our research was performed in The Chinese University of Hong Kong, Shenzhen, a young university in southern China. Different from majority of universities in mainland China, CUHK(SZ) inherits the education and evaluation system from CUHK. The study fee in CUHK(SZ) is 95000 CNY per year according to official announcement.

### IV. RESULTS

#### A. Received Data

1) *Self-reported GPA and PSQI*: From November 22nd to December 4th, a questionnaire covering self-reported GPA and PSQI questions was posted online, and 117 students in CUHK(SZ) participated in the research with 91 answer sheets being eventually received. Collected and clustered data are shown as Figure 1.

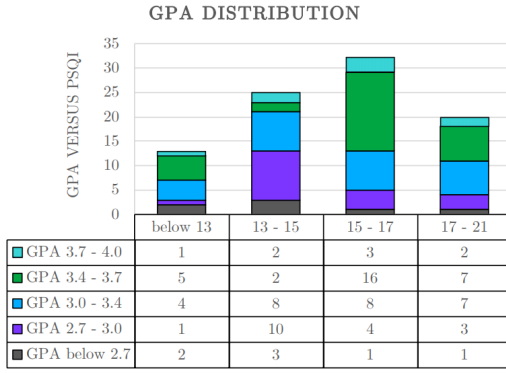


Fig. 1. Statistics of Self-reported GPA and PSQI

From Figure 1 it can be observed that when the PSQI score increases, there is a significant growth in the proportion of GPA interval 3.4 - 3.7 and 3.7 - 4.0, and also a notable decrease in the proportion of GPA interval 2.7 - 3.0. In order to look deep into the correlation of two variables, we then performed correlation analysis based on 91 received questionnaires.

After calculating the correlation coefficients for each GPA interval a table was obtained as Figure 2. From Figure 2 the PSQI score is found to be positively correlated with the proportion of higher self-reported GPA and negatively correlated with the proportion of lower self-reported GPA.

GPA Interval	4.0 - 3.7	3.7 - 3.4	3.4 - 3.0	3.0 - 2.7
Correlation Coefficient	0.4685	0.2717	-0.4646	-0.2607

Fig. 2. Calculation of Correlation Coefficients between PSQI and Self-reported GPA

In order to look deep into the correlation we then performed correlation analysis between each distinct components of PSQI and self-reported GPA. Figure 3 shows the correlation coefficient of self-reported GPA and each distinct component of PSQI.

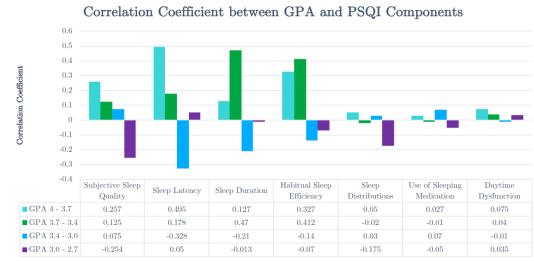


Fig. 3. Calculation of Correlation Coefficients between PSQI Components and Self-reported GPA

2) *Corrigendum of Linear Algebra Quiz and PSQI*: In November 27th, we handed out PSQI questionnaires in MAT-2040 in-class evaluation and the collected result are shown as Figure 4. From Figure 4 we can conclude that the rate of

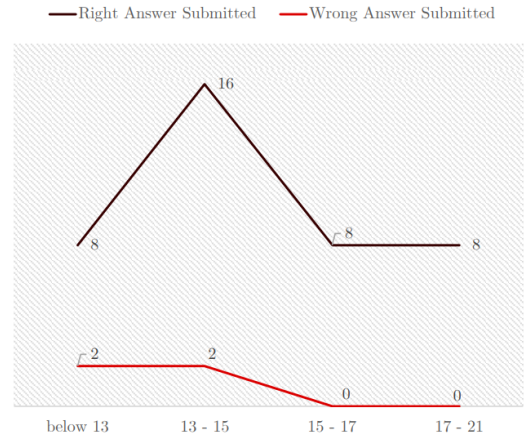


Fig. 4. Statistics of In-class Evaluation Corrigendum and PSQI

wrong submission decreases when PSQI score increases.

### V. DISCUSSION

The objective of this research is to investigate the relationship between sleep qualities and academic performance. Different from previous researches a cross-validation was engaged in our research, which aimed to enhance the reliability and credibility of our result.

Based on the result from self-reported GPA and PSQI questions high overall sleep qualities are found to enhance students academic performance while poor sleep qualities turn to reduce students' academic performance. This finding supports the hypothesis proposed before the research that self sleep qualities have influences on self academic performance. Conclusion can also be cross-validated by Figure 4 that when PSQI score increases the proportion of wrong submissions in in-class evaluation decreases.

To further explore the implicit factors which play key roles in affecting academic performance, we then performed correlation analysis among each distinct component of PSQI and self-reported GPA. The graph shows that sleep latency is the most significant factor to the academic performance

of students in GPA interval 3.7 - 4.0 and interval 3.0 - 3.4, while students in GPA interval 3.4 - 3.7 are affected by sleep duration most. Also, the majority of students in interval 2.7 - 3.0 are unsatisfied with their current sleep quality. Among the seven components in PSQI questionnaire psychological factors are found to have stronger influences to students' academic performance compared with the influences physiological factors have to students' academic performance.

After analyzing received result, we can propose our explanation to the previous discoveries. First, sleep duration have the least impact on students who obtained higher GPA, and the majority of students who obtained higher GPA are subjectively satisfied with their sleep quality. Compared with a catholic unsatisfactory among students who obtained lower GPA to their sleep quality, we hold that subjective attitudes towards self sleep quality are vital factors to self academic performance. Second, students who have higher GPA turn to have less difficulties in keeping a reasonable rest schedule, and easier to fell into sleep, either. A possible reason is controllable lifestyle might help them maintain a suitable and reasonable study plan, and also contribute to a relaxed mood in studying.

Even though a valid conclusion was obtained from the research we designed, limitations and shortcomings of our research still appeared. First, the correlation analysis is over concentrate on the psychological and physiological factors which makes our research not practical and general enough. Second, an advanced research is necessary to enroll cognitive functions into correlation analysis as an intermediate role like the way our hypothesis proposed. Last, as a cross-validation in our research, proofs on the relationship between math score and overall academic performance are implicit and insufficient.

## VI. CONCLUSION

In this research we tried to explore the relationship between sleep qualities and academic performance. We applied a scientific and quantitive index PSQI to measure the sleep quality of respondents, and self-reported GPA was utilized to represent the academic performance of respondents. Also, a cross-validate section was performed to verify the conclusion. Although there are limitations and shortcomings in our research, we discovered and concluded that sleep quality is positively related to academic performance and positive attitudes towards one's sleep quality are important factors contributing to excellent academic performance. By showing the correlation between sleep quality and academic performance we hope our research can help college students in CUHK(SZ) notice the importance of sleep quality and maintain a reasonable and balanced rest schedule.

## VII. BIBLIOGRAPHY

- A. R., W., M. A. & C.(1998). Sleep Schedules and Daytime Functioning in Adolescents. *Child Development*, 875
- Buysse D. J., Reynolds C. F., Monk T. H., Berman S. R., & Kupfer D. J.(1989). The Pittsburgh Sleep Quality

Index: A New Instrument for Psychiatric Practice and Research. *Psychiatry Research*, 5.

- Dewald J. F., Meijer A. M., Oort F. J., Kerkhof G. A., & Bogels S. M.(2010). The Influence of Sleep Quality, Sleep Duration and Sleepiness on School Performance in Children and Adolescents: A Meta-Analytic Review. *Sleep Medicine Reviews*, 179
- Larberge L., Petit D., Simart C., Vitaro F., Tremblay R. E., & Montplaisir J.(2001). Development of Sleep Patterns in Early Adolescence. *Journal of Sleep Research*, 59
- Nebes R. D., Buysse D. J., Halligan E. M., Houch P. R., & Monk T. H.(2009). Self-Reported Sleep Quality Predicts Poor Cognitive Performance in Healthy Older Adults. *The Journals of Gerontology: Series B*, 180
- Paavonen E. J., Rikke, K., Pesonen A. K., Lahti J., Komsu N., Heinonen K., Porkka-Heiskanen T.(2010). Sleep Quality and Cognitive Performance in 8-year-old Children. *Sleep Medicine*, 386
- S. F. G. & W. T. S.(1995). Sleep Problems of Junior High School Students in Taipei. *Sleep*, 667
- Robert V. Hogg, Elliot A. Tanis, & Dale L. Zimmerman(2010). *Probability and Statistical Inference, ninth edition*, 136
- Entrance Expenses (2018). Retrieved from <http://admissions.cuhk.edu.cn/en/content/1919>