

# Research on the Correlation Between Sleep Quality and Academic Performance Among College Students

Song Mengxin, Li Kexin, Qu Yiran, Li Qing, Zhang Shuang

Beijing Wuzi University, Beijing, China

## ABSTRACT

Sleep deprivation is highly prevalent among college students, and various phenomena indicate a close relationship between sleep quality and academic performance. In this paper, we investigated the sleep quality and academic performance of college students, analyzing the data using the Pittsburgh Sleep Quality Index (PSQI), descriptive statistics, correlation analysis, textual analysis, and multiple modeling approaches. Through these analyses, we concluded that academic performance is significantly impacted by sleep quality, and provided relevant recommendations for future development.

**KEYWORDS:** college students; sleep quality; academic performance; data analysis; sleep improvement.

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## I. INTRODUCTION

### A. Research Background

In the field of education, students' learning performance is influenced by multiple factors. In recent years, intensified academic competition and the accelerated pace of university life have made sleep quality and academic performance among college students a topic of growing concern.

Practical observations indicate that sleep issues are widespread among college students. Many students experience irregular sleep patterns and insufficient sleep duration due to academic pressure, social activities, and electronic device usage. At the same time, academic challenges are increasing, requiring students to devote significant effort to coursework, exams, and research projects. Lack of quality sleep has serious consequences: studies show that college students often face mental health issues and sleep disorders. Targeted interventions based on risk factors can improve both mental health and sleep quality.

Previous research by the team has explored the relationship between attention span and lecture duration among high school students. Findings

revealed that attention peaks around 20–30 minutes and declines afterward, with interactive classes maintaining attention better than lecture-based ones. These insights provide a reference for examining how sleep quality affects academic performance in college students. Additionally, the rise of online learning has reduced teacher-student interaction, potentially further impacting focus and academic outcomes.

### B. Research Significance

1. Addressing Practical Needs: Over 60% of college students experience insufficient sleep (<7 hours) or irregular schedules. This study quantifies the impact of sleep quality (e.g., time to fall asleep, deep sleep ratio) on academic metrics (e.g., GPA, class participation), providing data to support sleep-improvement strategies.
2. Enhancing Education Systems: Results can help universities optimize class schedules and teaching methods. For instance, placing demanding courses during peak alertness periods or incorporating interactive elements in online classes can improve

learning efficiency.

3. **Informing Policy:** The study offers evidence for developing sleep health guidelines and mental health support programs. It can also promote institutional interventions, such as sleep monitoring apps or counseling services.
4. **Empowering Students:** By demonstrating the effects of sleep on memory and cognitive function (e.g., 40% decline in word retention due to poor sleep), students can adopt better self-management practices, such as reducing late-night device use or adopting sleep-friendly routines.

### C. Research Features and Innovations

#### 1. Innovative Research Perspective

This study moves beyond traditionally isolated focuses on either academic performance or sleep health by examining their intersection. It innovatively connects lifestyle factors (sleep quality) with academic outcomes, exploring the mechanisms through which sleep impacts academic performance—a perspective often overlooked in previous research that treated these domains separately.

#### 2. Innovations in Research Methods

1. **Integrated Methodology:** Combines quantitative (PSQI surveys), physiological (sleep monitoring), and qualitative (interviews) methods to assess multi-dimensional sleep quality and academic performance.
2. **Cross-Group Continuity:** Extends the team's previous work on attention span in high school students to college students, testing the applicability of the "attention peak" theory in higher education.
3. **Practical Application:** Proposes a dynamic sleep-academic management model to support tailored university interventions (e.g., flexible scheduling, wellness tracking systems).
4. **Ethics and Privacy:** Ensures full anonymity and informed consent; no sensitive personal data is collected.
5. **Implementation:** Uses real-time sampling monitoring and emphasizes caution in interpreting results.

The study also utilizes large-scale data analysis to identify variations across majors, grades, and genders, predicting academic outcomes based on sleep patterns—a rare approach in existing literature.

### Survey Plan

#### A. Survey Objectives

1. Assess sleep quality among students at Beijing Wuzi University using the Pittsburgh Sleep Quality Index (PSQI).

2. Evaluate academic performance levels among respondents.
3. Identify key factors influencing sleep quality as perceived by students.
4. Examine methods used by students to improve sleep and measure their effectiveness.
5. Investigate the perceived impact of sleep quality on academic performance.

#### B. Target Population and Unit

Population: All students at Beijing Wuzi University

Unit: Individual student

#### C. Survey Content

The survey covers six dimensions:

1. Personal information
2. Sleep quality (PSQI-based)
3. Academic performance
4. Factors influencing sleep quality
5. Attempted sleep improvement methods and their effects
6. Perceived impact of sleep on academic performance

A structured questionnaire has been designed to collect data across these areas.

#### Basic Steps of Sampling Survey

##### 1. Determining Sample Size

To calculate the required sample size:

First, define the confidence level (set at 95%) and the margin of error (set at 5%).

Then, estimate the population proportion based on pre-survey data or existing studies. A conservative estimated proportion of 50% is often used.

Finally, apply the standard sample size formula for proportion estimation:

$$n = \left( \frac{Z^2 + p \cdot (1-p)}{E^2} \right)$$

Z is the Z-value corresponding to the confidence level (1.96 for a 95% confidence level), p is the estimated population proportion (0.5), and E is the margin of error (0.05). Substituting these values into the formula yields:

$$n = \left( \frac{1.96^2 + 0.5 \cdot 0.5}{0.05^2} \right)$$

Since the sample size must be a whole number, the result is rounded up to 385. **\*\*Final Sample Size Adjustment:\*\***

To account for potential attrition (e.g., invalid responses, missing data), a non-response rate of 20% is assumed. The adjusted required sample size is calculated as follows:

$$n_{\text{adjusted}} = \frac{385}{1-0.2} = 481.25$$

## 2. Basic Steps of Sampling Survey

### 3. Questionnaire Design

The questionnaire includes:

Personal information: Gender, grade, major, etc.

Sleep quality assessment: Based on the Pittsburgh Sleep Quality Index (PSQI).

Academic performance evaluation: Collecting data on GPA and self-rated academic efficiency.

Factors affecting sleep and improvement measures: Identifying key influences and solutions.

-Perceived impact of sleep on academic performance: Providing direct evidence for the study.

### 4. Pilot Survey

A small-scale pilot survey (100 respondents) was conducted to test reliability and validity:

Reliability: Cronbach's Alpha = 0.919, indicating high internal consistency.

Validity: KMO value = 0.785, and Bartlett's test ( $p = 0.000$ ) confirmed suitability for factor analysis.

### 5. Formal Survey

After passing the pilot test, the questionnaire was distributed university-wide. 486 valid responses were collected for further analysis.

## II. Data Analysis and Conclusions

### 1. Pittsburgh Sleep Quality Index (PSQI)

The PSQI was used as a reliable tool to assess sleep quality. Data were visualized to support analysis.

### 2. Analytical Methods

Software: SPSS and Excel were used for statistical analysis and visualization.

Methods: Descriptive statistics, Pearson correlation, multiple linear regression, and ANOVA were applied to examine relationships between sleep quality and academic performance.

### 3. Data Preprocessing

Data cleaning involved handling missing values and removing outliers (e.g., unrealistic sleep durations or GPAs).

Final dataset: 486 valid cases.

### 4. Descriptive Analysis of Core Variables

Sleep quality:

Average sleep duration: 1.86 (on a coded scale).

46.1% of students fell asleep within 15 minutes;

4.7% took over an hour.

55.1% reported no difficulty falling asleep.

Academic performance:

Average GPA: 3.22 (on a 4.0 scale).

### 5. Correlation Analysis

Sleep duration and GPA: Significant negative correlation ( $r = -0.122$ ,  $p < 0.01$ ).

Self-rated sleep quality and GPA: Significant negative correlation ( $r = -0.160$ ,  $p < 0.01$ ).

Regression analysis: Sleep duration negatively predicted GPA ( $\beta = -0.210$ ,  $p = 0.002$ ).

### 6. Reliability Test

Cronbach's Alpha = 0.734 (68 items), indicating acceptable reliability.

### 7. Conclusions

Sleep quality significantly affects academic performance.

Shorter sleep duration and poorer self-rated sleep quality are associated with lower GPAs.

Cognitive functions (e.g., logical thinking, memory) mediate this relationship.

High-achieving students often report anxiety and procrastination-related sleep issues.

## III. Improvement Measures Analysis

### 1. Word Cloud Analysis

Positive sleep experiences: Associated with "health," "comfort," and "relaxation."

Negative sleep experiences: Linked to "fatigue," "stress," and "insomnia."

### 2. Intervention Recommendations

Behavioral adjustments: Fixed schedules, reduced screen time before bed, increased daytime exercise.

Environmental optimization: Blackout curtains, noise-cancelling tools, comfortable bedding.

Psychological support: Workshops on sleep and stress management, mindfulness practices.

### 3. Data-Driven Suggestions

50.5% of students had not attempted sleep improvement, highlighting a need for awareness campaigns.

Effective interventions include personalized plans and institutional support (e.g., sleep-friendly campus policies).

## IV. Future Directions

### 1. Methodological Enhancements

Longitudinal studies to establish causality.

Multimodal data (e.g., wearable devices, neuroimaging) for objective measures.

Cross-cultural and cross-institutional comparisons.

### 2. Expanded Research Scope

Include diverse student populations (e.g., different majors, grades).

Focus on high-risk groups (e.g., medical students).

### 3. Intervention Development

Machine learning-based personalized sleep improvement plans.

Sleep health integration into university policies and campus infrastructure.

#### 4. Theoretical and Practical Applications

Interdisciplinary models combining education, psychology, and neuroscience.

Public outreach and collaboration with tech companies for scalable solutions.

#### 5. Addressing Limitations

Broader sampling to improve representativeness.

Refined measurement tools and advanced statistical methods.

#### 6. Overall Summary

Future research aims to develop a holistic framework linking sleep quality and academic performance, enabling targeted interventions and promoting student well-being.

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