

Impact of Sleep Pattern on Students Academic Performance

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Peer Review Information	Abstract
<p>Type: Article Received: 26 March 2026 Revised: 20 April 2026 Accepted: 22 May 2026 Published: 01 June 2026</p>	<p>Sleep is a basic need that has a big impact on how well people think, feel, and remember things, especially for young adults. This study looks at how different aspects of sleep like how long you sleep, how well you sleep, and how regular your sleep schedule is can affect the grades of college students, as shown by their Grade Point Average (GPA). A dataset with 500 student records, from Kaggle, was used for this study. The data was cleaned and explored using Python tools. Two types of machine learning models Random Forest and Decision Tree (J48) were used to find out how well sleep factors can predict academic success. The findings show that students who sleep regularly and get around 7 to 8.5 hours of sleep usually do better in school. The Random Forest model was very accurate, with a 97% success rate, showing how strong the link is between sleep and academic performance. These results show how important it is for students to have good sleep habits to improve their school results.</p> <p>Keywords: Sleep patterns, academic performance, GPA, Random Forest, Decision Tree, machine learning, student wellness.</p>

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Introduction

Modern undergraduate students often have very hectic schedules as they juggle their studies, part-time jobs, extra activities, and social events all at the same time. Because of these many responsibilities, sleep is usually the first thing they cut back on. However, this choice can have a negative effect on their academic results, even though the consequences might not be obvious right away.

Sleep is more than just resting; it is also important for how the brain works.

While you sleep, your brain processes new information, makes stronger connections between brain cells, and helps manage emotions. If you don't get enough or regular sleep, it can lead to problems with memory, trouble staying focused, and higher stress levels, which all make it harder to learn and perform well in exams.

Health guidelines suggest that young adults should aim for seven to nine hours of sleep each night to support their mental and emotional health [1].

But in reality, many college students don't reach this target. Not getting enough sleep causes more than just being tired—it's connected to lower grades, less participation in class, and difficulty recalling what was learned.

Even though past research has looked into the connection between sleep and academic success, there are some shortcomings.

A lot of these studies depend on people reporting their own sleep habits, which might not always be accurate. Also, traditional ways of analyzing data might not fully show the complex ways different lifestyle factors are connected [2]. To address these issues, this study uses a computer-based method by applying machine learning tools to better understand and predict how sleep habits affect academic performance.

Literature Review

For a long time, scientists have been looking into how sleep affects how well people think and learn. Early work by Curcio and others showed that if you don't get enough sleep or if your sleep is broken up, it can make it harder to learn and do worse in school. Later studies found that it's not just about how long you sleep, but also about keeping a regular sleep schedule. They discovered that going to bed and waking up at the same times every day helps improve school performance.

Wolfson and Carskadon found that students who stick to a regular sleep and wake-up time usually do better during the day and are more focused in their studies.

Similarly, Hershner and Chervin noted that being very sleepy during the day is a common but often overlooked issue that can hurt success in college. A big study by Dewald and others showed that both how well you sleep and how much you sleep can both help with academic success. Also, Pilcher and Huffcutt found that not getting enough sleep can make it harder to move around and can also make someone feel more irritable.

Even though there is a lot of research showing the connection between sleep and academic results, there is still an important missing piece.

Very few studies have used real data from people's everyday lives along with machine learning to create models that can predict how sleep habits affect academic outcomes. This study is meant to address that gap.

Even though there is strong research supporting the link between sleep and academic outcomes, an important gap still exists. Very few studies have used real-world datasets along with machine learning methods to build predictive models based on sleep behavior. This study aims to fill that gap.

Proposed Methodology

Dataset

This study makes use of a dataset from Kaggle [2], which has 500 student records that have been made anonymous. Each record includes both behavior and academic details, such as:

- Sleep Duration: The average number of hours a student sleeps each night
- Sleep Quality: A self-reported score on a scale from 1 to 10
- GPA: The grade point average, measured on a 4.0 scale
- Class Attendance: The percentage of classes a student attends
- Stress Level: A self-reported measure of stress
- Caffeine Intake: How much caffeinated drinks a student consumes daily

Preprocessing and EDA

The raw dataset was cleaned using Python tools like Pandas and NumPy. This process included fixing missing data, changing text-based categories into numbers, and adjusting numerical values to make them consistent. Once the data was ready, it was split into two parts—80% for training a model and 20% for testing it, so the model's performance could be checked fairly.

Exploratory Data Analysis (EDA) was done using Seaborn and Matplotlib to look for patterns and connections in the data. As shown in Fig. 1, students who got between 7 and 9 hours of sleep each night tended to have higher GPA scores, showing a clear positive relationship between sleep duration and academic success.

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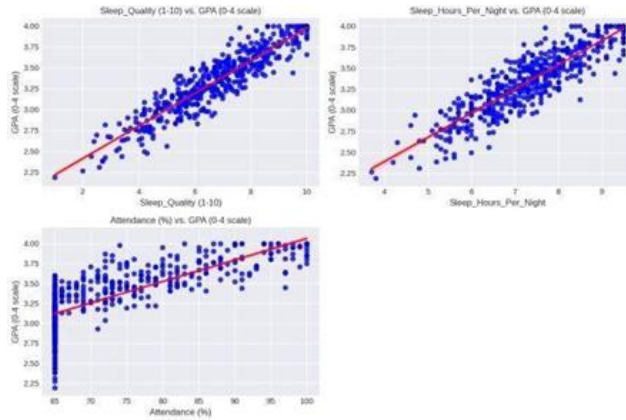


Fig. 1. Relationship between nightly sleep hours and GPA

The correlation heatmap (Fig. 2) shows that sleep duration and sleep quality have the strongest positive relationship with GPA, while stress level is negatively related to academic performance.

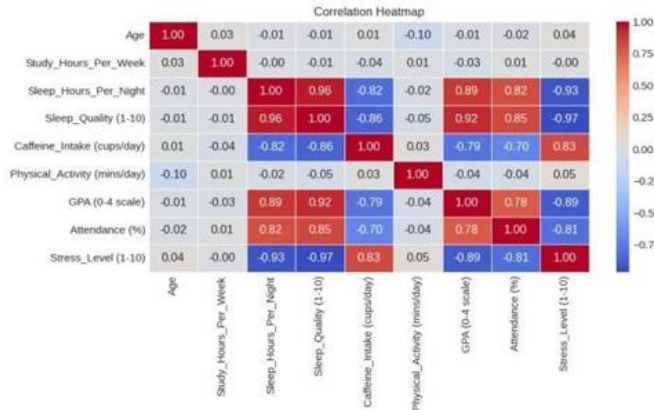


Fig. 2. Pearson correlation map across sleep and lifestyle variables

Machine Learning Models

Random Forest Classifier: Random Forest is a type of learning method that uses many decision trees together to make better predictions and avoid overfitting [8]. In this study, it was used to figure out which sleep-related features are most important.
 J48 Decision Tree: The J48 Decision Tree is a model that uses rules to make decisions. It was implemented using scikit learn's Decision Tree Classifier. It was picked because it's easy to understand and gives clear rules that students and academic advisors can follow.
 The GPA values were split into three groups — Low, Average, and High — so the problem could be handled as a multi-class classification task. The models were checked using performance measures like accuracy, precision, recall, and F1-score.

Results and Model Evaluation

Table I presents the performance of both models on the test dataset.

TABLE I. Model Performance Comparison

Model	Accuracy	Precision	Recall	F1-Score
Random Forest	97%	91.3%	91.0%	91.1%
Decision Tree	93%	85.7%	85.0%	85.2%

In terms of how well the models performed, the Random Forest classifier outperformed the Decision Tree on all the evaluation measures, reaching an overall accuracy of 97%. This indicates its effectiveness in understanding the complex connections between sleep patterns and other lifestyle factors. The J48 Decision Tree achieved 93% accuracy and offered a clear and easy-to-follow structure, where sleep quality was identified as the key factor influencing the prediction of GPA categories.

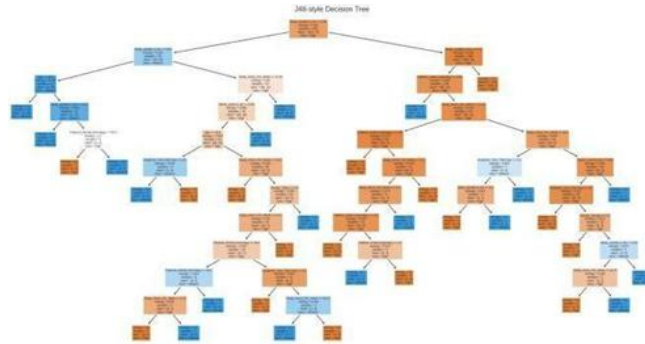


Fig. 3. J48 Decision Tree — sleep quality as root classifier node

As shown in Fig. 3, students who have better sleep quality are mostly grouped into the High GPA category. On the other hand, students with poor sleep quality, especially when they also have high stress levels, are usually placed in the Low GPA group. Study time and caffeine consumption also play a role, but their impact is less significant compared to sleep quality and stress.

Discussion

The results back up the idea that how well someone sleeps and how consistent their sleep schedule is can really affect how well they do in school. Two big parts of sleep were especially important: the quality of sleep and sticking to a regular bedtime and wake-up time. Students who had good quality sleep and kept a consistent schedule did better in their studies, even if they weren't getting the usual recommended amount of sleep each night.

This shows that focusing on keeping a regular sleep schedule might be more helpful than just trying to get more sleep, especially for students who have a lot going on.

The study also found that stress and drinking caffeine can change sleep patterns and affect grades in combination with sleep habits. This means that health and wellness experts should take these factors together into account.

The study used a machine learning method that has some clear benefits over older statistical techniques.

By looking at many factors at once, the Random Forest model was able to find complicated connections that simpler methods might not catch.

Implications and Applications

These findings can be useful for different groups. For students, understanding how sleep quality impacts their grades can encourage them to form better habits, such as maintaining a regular sleep schedule and managing stress in a healthy manner.

At the university level, these findings can support efforts to improve student wellness.

Schools could organize sleep awareness programs or adjust their class times to prevent starting too early.

Key Findings

- Students who got about 7 to 8.5 hours of sleep each night and had a regular bedtime routine usually had better grades.
- Keeping a steady sleep schedule was just as important as how much sleep you got when it came to doing well in school.
- The Random Forest model was right 97% of the time, showing that factors related to sleep are strong signs of a student's GPA.
- In the J48 Decision Tree model, how good your sleep was turned out to be the biggest influence on your GPA.
- High stress and drinking a lot of caffeine made the bad effects of not getting enough sleep worse on school performance.

Conclusion

This study offers evidence based on real data showing that how well students sleep has a big effect on their academic performance. By using both data exploration and machine learning methods, the research goes beyond just looking at simple connections and creates a model that can accurately predict academic success based on sleep and lifestyle habits.

The results show that both getting enough sleep and keeping a consistent sleep schedule are key.

They also suggest that both students and schools should see good sleep as an important part of achieving academic success. Future research can make these findings even better by using longer-term data and including more factors like screen time, exercise, and diet to create more precise models for different groups of students.

References

1. National Sleep Foundation. (2025). How much sleep do we really need? Retrieved from <https://www.sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need>
2. Kaggle. (2024). Student Sleep and Academic Performance Dataset. Retrieved from <https://www.kaggle.com>
3. Shochat, T., Cohen-Zion, M., & Tzischinsky, O. (2014). Functional consequences of inadequate sleep in adolescents: A systematic review. *Sleep Medicine Reviews*, 18(1), 75–87.

4. Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. *Nature and Science of Sleep*, 6, 73–84.
5. Dewald, J. F., Meijer, A. M., Oort, F. J., Kerkhof, G. A., & Bögels, 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*, 14(3), 179–189
6. Gilbert, S. P., & Weaver, C. C. (2010). Sleep quality and academic performance in university students: A wake-up call for college psychologists. *Journal of College Student Psychotherapy*, 24(4), 295–306.
7. Curcio, G., Ferrara, M., & De Gennaro, L. (2006). Sleep loss, learning capacity and academic performance. *Sleep Medicine Reviews*, 10(5), 323–337.
8. Breiman, L. (2001). Random forests. *Machine Learning*, 45(1), 5-32.
9. Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development*, 69(4), 875–887.
10. Pilcher, J. J., & Huffcutt, A. I. (1996). Effects of sleep deprivation on performance: A meta-analysis. *Sleep*, 19(4), 318–326.