Navigating Night: Behavioral Economics Strategies to Improve Sleep Patterns Among College Students

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Background

In contemporary society, the rapid pace of life and increasing pressures have led many young people to experience a significant scarcity of time, often referred to as time drought or time anxiety. This phenomenon is extensively discussed on social media, where individuals share time management strategies and reviews of time-tracking software, indicating a societal shift towards maximizing every minute. Studies suggest that about 130 million young adults in China alone are affected by disrupted sleep patterns due to late nights (Lin et al., 2022; Zhao et al., 2022). Globally, staying up late has become a common lifestyle among the youth, which often extends into the domains of work and leisure, influencing their daily routines and overall health (Gao et al., 2024).

The root causes of this trend can be traced to psychological and social pressures (Carskadon, 2002). Many young people stay up late as a form of 'retaliatory staying up late' (Duraccio et al., 2022), where they reclaim the nighttime for personal activities, viewing it as a necessary trade-off for the lost leisure time during the day. This behavior is often a response to the inability to complete tasks within conventional work hours,

forcing them to extend their active hours into the night. The essence of this behavior reflects a complex psychological state where individuals overcompensate for daytime restrictions and stress by indulging in latenight activities, despite being aware of the potential health risks. This compensatory behavior is particularly prevalent among those who feel a strong disconnect between institutional time rhythms and personal goals, leading them to sacrifice sleep as a way to manage time and assert control over their lives.

This essay focuses on the issue of college students staying up late, proposing experimental solutions grounded in behavioral economics to mitigate this problem (Yoshimura et al., 2009). By leveraging theories that consider how psychological and social factors influence decision-making, we aim to design interventions that encourage healthier sleep habits. Through these strategies, we hope to demonstrate that behavioral economics can effectively improve sleep patterns and overall well-being among college students.

Behavioral Economic Theories Related to Staying Up Late

With regard to the phenomenon of staying up late, the following theoretical connections have been made:

Time inconsistency: Time inconsistency refers to the preference for immediate gratification over long-term rewards, a crucial factor in understanding why college students choose to stay up late. Students often prioritize engaging in immediately enjoyable activities such as socializing, gaming, or binge-watching series, over the

longer-term benefit of adequate sleep, which is essential for their health and academic performance. This tendency to prioritize short-term pleasures leads to a misalignment between their immediate actions and their long-term well-being.

Loss Aversion: "Loss aversion" can also explain why many people are aware of the harm caused by staying up late but still choose to continue staying up late (Gal & Rucker, 2018; Novemsky & Kahneman, 2005; Schmidt & Traub, 2002). In contemporary society, everyone faces a lot of pressure, which may come from family, work, or study. After a long day of exhaustion, the only free time left for them is in the evening. During this time, people can temporarily set aside workplace or school pressures and do some relaxing things such as scrolling on their phones, chatting with friends, or watching movies. This evening time that belongs to oneself is also referred to as "me time". When people choose to stop staying up late, "me time" will decrease, leading to a sense of loss. To avoid experiencing this sense of loss, people continue to stay up late.

Self-Control: This preference for immediate rewards is closely linked to self-control, which involves the ability to regulate impulses and resist short-term temptations in favor of long-term gains. In the context of staying up late, a lack of self-control manifests as an inability to resist distractions and go to bed at a reasonable hour. The pull of immediate rewards often overpowers the knowledge that they should be sleeping, illustrating a classic self-control dilemma (Inzlicht et al., 2014; Rachlin, 1974).

Procrastination: Procrastination exacerbates the issues of time inconsistency and self-control (Klingsieck, 2013). Students delay tasks until the night, often because daytime hours are spent in less pressing but more enjoyable activities (Day et al., 2000). This

procrastination pushes essential tasks to late hours, necessitating that students stay up late to complete them, which not only disrupts their sleep patterns but also sets a cycle of sleep deprivation impacting their productivity and health (Wilson & Nguyen, 2012).

Regarding the experimental approach to remedying late nights, here are the following theoretical links:

Nudge theory, suggests that by subtly reengineering the environment, one can encourage better decision-making. In terms of curbing the habit of staying up late, small incentives can "encourage" students to adopt healthier sleep patterns, effectively aligning their immediate choices with their long-term health (Arno & Thomas, 2016).

Incentive theory, suggests that behavior can be motivated by rewards. Applied to improving students' late-night habits, offering incentives for adhering to earlier bedtimes could motivate behavior change (Killeen, 1981). This approach could shift night owls towards healthier sleep patterns by providing tangible benefits to encourage and reinforce the desired behavior.

Experiment Methodology

The objective of our study is to investigate how the principles of behavioral economics can be applied to reduce late-night studying among college students while simultaneously improving their academic performance and overall well-being. This research aims to address the prevalent issue of night owl behavior among students by utilizing proven behavioral economic techniques. To achieve this, we have established one control group and three treatment groups to evaluate the effectiveness of three

distinct principles in reducing the tendency of students to stay up late (Liu & Li, 2023; Zhao et al., 2024).

Late-night behavior is especially common among young adults, particularly teenagers and young adults, including high school and college students, as well as young professionals entering the workforce. Factors contributing to this behavior include academic pressures, late-night social activities, work-related stress, and various forms of entertainment such as games and movies. Considering practical feasibility, accessibility, and representativeness of the subjects, we plan to focus on selecting college students as our experimental subjects. Given their greater autonomy, these students provide an optimal population for experimental participation and data collection. Additionally, conducting the experiment on a university campus allows for a controlled environment, facilitating data collection and monitoring.

Before the experiment begins, we will design a comprehensive questionnaire that focuses on collecting data regarding students' sleep patterns, academic performance, and overall physical health. The detailed content of the questionnaire can be found in the appendix. To minimize confounding variables and enhance the reliability and validity of the experimental results, we will carefully screen potential subjects. Students with serious sleep disorders such as insomnia and narcolepsy, as well as those with chronic illnesses or severe mental health conditions, will be excluded from the study. These individuals may require professional medical interventions rather than experimental approaches, and their medication use may impact sleep patterns and subsequently influence our experimental results. Furthermore, students who are

currently engaged in intensive internships or undergoing intensive study periods within a short duration may not have the necessary time to fully participate in the experiment, so they will also be excluded from the sample. When recruiting experimental participants, we will strive to select subjects from different disciplines, genders, and age groups to ensure diversity and representativeness in the sample.

In our experimental design, we will have one control group and three treatment groups: T1) Nudge Theory Group, T2) Default Option Group, and T3) Loss Aversion Group. All participants will be invited to install a sleep monitoring app on their watches or phones to track their sleep duration and quality. Additionally, participants in the first treatment group will receive extra sleep reminders from the app at their predetermined bedtime. Prior to the experiment, participants will be informed about the app's functions, and their consent will be obtained for its use. All participants will be randomly allocated to each experiment group and each group will include approximately 50 participants. Before the experiment begins, each participant will specify in advance their planned bedtime. Now let's detail the settings for each experimental group.

The control group: It serves as a baseline for comparison, allowing us to measure the effectiveness of interventions in the three treatment groups. By assessing differences between the control group and each treatment group, we can determine the efficacy of each behavioral economic principle being tested.

T1: The Nudge Theory Group will explore the application of nudge theory in reducing the tendency to stay up late. Nudge theory guides individuals toward making better decisions by making small adjustments to their decision-making environment.

Participants in this group will receive bedtime reminders from the app, which will also provide tips on healthy sleep habits, such as avoiding electronic devices before bedtime and maintaining a quiet, dark sleeping environment. The app may also offer soothing music to promote sleep.

T2: Status quo bias refers to the psychological tendency of people to maintain their current status and resist change. Therefore, in the second group, we will rent dormitories and let all the students in the second group live in dormitories, which can facilitate unified management. In this setting, the living environment of the dormitory becomes the default state for students and they do not need to make extra effort to maintain this lifestyle. We took two specific measures: turning off the lights after 11pm, and restricting Internet speeds after 11pm. The aim of these measures is to influence students' behavior patterns, especially their late-night habits, by modifying the default Settings of the environment.

T3: Loss aversion is a significant reason why people stay up late. Individuals may experience a sense of loss if they disrupt their established sleep routines by going to bed earlier, primarily due to the reduction of personal leisure time. To address this, we propose using a reward and punishment mechanism to counteract loss aversion. Participants will receive $10 if they adhere to their pre-arranged bedtime and will be charged $10 if they fail to do so. Funds collected from penalties will be donated to the university's charity program. The reward amounts will gradually increase, starting with $5 per day in the initial phase, $10 per day in the second phase, and $15 per day in the third phase.

The whole experimental period was 28 days, including three experimental weeks and one observation week without intervention.

Period 1: Initial Implementation of Interventions

The experiment begins with the immediate introduction of interventions tailored to each group:

Control Group: No interventions are applied to maintain a baseline for comparison.

T1: Participants receive bedtime reminders and sleep habit tips via an app from the start.

T2: Participants move into dormitories with strict regulations, including lights out and internet restrictions starting at 11 PM.

T3: The reward and penalty system is activated, with participants receiving monetary rewards or penalties based on adherence to pre-set bedtime schedules.

Period 2: Continuation and Data Collection

Interventions continue as established in Period 1 with ongoing data collection. This period allows for the assessment of the initial impact of each intervention and begins to provide insights into behavioral changes and participants' adaptations to the introduced conditions.

Period 3: Further Observation and Adjustment

The interventions are maintained, and any necessary adjustments based on observed outcomes or participant feedback are implemented.

Period 4: Post-Intervention Monitoring

All interventions are ceased to observe the residual effects of the treatments. This period aims to evaluate whether the changes observed during the intervention phases persist, decrease, or revert to pre-intervention patterns.

Results

Based on the experimental design you provided, we can make some reasonable predictions about the results of each phase.

Experimental Phase Predictions:

Period 1: Initial Implementation of Interventions

Control Group: No significant changes are expected as no interventions are applied to maintain a baseline for comparison.

T1 (Nudge Theory Group): There may be a slight positive impact as reminders and suggestions may encourage some students to go to bed earlier.

T2 (Default Option Group): There may be a more noticeable positive impact as environmental changes (lights out and internet restrictions) force students to adjust their behavior.

T3 (Loss Aversion Group): There may be a significant positive impact as the monetary incentive may strongly encourage students to adhere to their predetermined bedtime.

Period 2: Continuation and Data Collection

Control Group: Continues with no changes.

T1: The effect may strengthen as students may start to get used to the reminders and suggestions.

T2: Students may begin to adapt to the new environment, and the effect may weaken somewhat but still be better than the initial state.

T3: The monetary incentive may start to have the greatest effect as students may have already formed new sleep habits.

Period 3: Further Observation and Adjustment

Control Group: Remains unchanged.
T1: Some adjustments may be made to enhance the effectiveness of reminders and suggestions.

T2: Environmental settings may need fine-tuning to maintain student compliance.

T3: The reward and penalty mechanism may be adjusted based on student feedback.

Period 4: Post-Intervention Monitoring

Control Group: Expected to return to baseline levels.

T1: Some lasting positive effects may be observed, but they may not be as significant as those in T3 Group.

T2: The effects of environmental changes may persist for a while, but students may gradually revert to their habits.

T3: After the monetary incentives are removed, it is expected that the students' sleep times in this group will decrease the most, especially if they are highly dependent on the monetary incentives. However, if they have already formed new sleep patterns during the experimental period, the decrease may not be as significant as expected.

Final Summary Prediction:

In the cycle following the experiment's conclusion, we predict that:

Control Group: Students will likely exhibit no significant change, as there was no intervention to alter their behavior.

T1: Some lasting positive effects may be present, but they may not be as significant as in other groups.

T2: Students may gradually return to their late-night habits, but the environmental changes may still have some positive impact.

T3: It is expected that this group will show the most significant decline, as the disappearance of loss aversion and monetary incentives may lead students back to their previous late-night habits. However, if they have already established a more stable sleep pattern during the experiment, the decline may be less pronounced than anticipated.

Limitations

The experimental design outline has several limitations that should be considered. The purpose of this experiment is to examine the effects of behavioral interventions, such as restricting usage time and providing rewards, on students' late-night studying behavior. We aim to reduce the frequency of students staying up late, improve their sleep quality, and consequently enhance their academic performance and overall wellbeing. However, there exists potential bias in data collection. Firstly, the reliance on self-reported data through surveys may introduce bias. Participants may be inclined to

overstate the amount of time they spend studying, underestimate their use of social media before bed, or inaccurately remember their sleep patterns and academic

achievements. A possible solution is to use a watch or sleep monitoring software to modify this bias.

Secondly, the long-term impact of interventions may not be fully felt. Even though improvements in behavioral economic strategies on students' study habits, sleep quality, and academic performance will be observed during and after the experiment, longerterm follow-up is needed to assess the ongoing impact of the intervention.

Finally, our second group of experiments start from the unified arrangement of all participants in the dormitory environment. Although this setting is conducive to controlling the study variables, the actual situation is complicated and students live in a variety of environments. And the setup of the experiment relies on sufficient funds to arrange accommodation, which is also the ideal situation.

Appendix 1

Pre- Experiment Questionnaire

1. Gender

   ☐ Female

   ☐ Male

2. Age

   ☐ 19-21 years old

   ☐ 22-24 years old

   ☐ 25-27 years old

   ☐ ≥ 28 years old

3. How often do you stay up past midnight studying during the week?

   ☐ Never

   ☐ Rarely

   ☐ Occasionally

   ☐ Frequently

   ☐ Almost every night

4. How would you rate the quality of your sleep on a scale of 1 to 5 (1 being poor, 5 being excellent)?

   ☐ 1

   ☐ 2

   ☐ 3

   ☐ 4

   ☐ 5

5. How often do you feel fatigued or tired during the day due to lack of sleep?

   ☐ Never

   ☐ Rarely

   ☐ Occasionally

   ☐ Frequently

☐ Almost every day

6. Do you currently use any apps or tools to help you manage your sleep schedule?

   ☐ Yes

   ☐ No

7. On a scale of 1 to 5, how difficult do you find it to disconnect from electronic devices before bedtime? (1 Not difficult at all, 5 Extremely difficult)

   ☐ 1

   ☐ 2

   ☐ 3

   ☐ 4

   ☐ 5

8. How frequently do you engage in social media activities in the evening before bed?

   ☐ Never

   ☐ Rarely

   ☐ Occasionally

   ☐ Frequently

   ☐ Almost every night

   List the social media that you frequently use.

   _____

9. Have you ever received any penalties or fines for violating dormitory rules regarding noise or late-night disturbances?

   ☐ Yes

   ☐ No

10. How often do you experience stress or anxiety related to academic performance?

    ☐ Never

    ☐ Rarely

    ☐ Occasionally

    ☐ Frequently

☐ Almost every day

11. How motivated are you to improve your sleep habits and academic performance?

☐ Not motivated at all
☐ Slightly motivated

☐ Moderately motivated

☐ Very motivated

☐ Extremely motivated **Appendix 2**

Post- Experiment Questionnaire

Here's a post-experiment questionnaire designed to assess the effectiveness of the interventions and gather feedback from participants:

1.Do you find the intervention helpful in improving your sleep habits?

☐ Yes

☐ No

2.Do you find the intervention helpful in improving your academic performance?

☐ Yes

☐ No

3. Do the relaxation reminders help you to unwind before bed?

☐ Yes

☐ No

4. Do the default options (e.g., dimming lights, slowing Wi-Fi) encourage you to go to bed early?

☐ Yes

☐ No

5.Do the reward mechanism or penalties influence your bedtime behavior?

☐ Yes, positively

☐ Yes, negatively

☐ No

6.How would you rate your overall sleep quality during the experiment period compared to before?

☐ Better

☐ Worse

☐ No change

7.Did you experience any unintended consequences or side effects from the interventions?

☐ Yes (If yes, please specify:_____)

☐ No

8.How satisfied are you with the overall experience of participating in this experiment?

☐ Very satisfied

☐ Somewhat satisfied

☐ Neutral

☐ Somewhat dissatisfied

☐ Very dissatisfied

9.How do you think this program can be improved on?

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