# THE CONNECTION BETWEEN SLEEP PATTERNS AND MEMORY CONSOLIDATION: COUNSELING STRATEGIES FOR ENHANCING MEMORY BEFORE EXAMINATIONS

**Pauline Ifeyinwa Tibi**
Department of Educational Foundation, University of Delta, Agbor, Nigeria. Pauline.tibi@unidel.edu.ng

## Abstract

*This theoretical essay explores the relationship between sleep habits and memory consolidation, advising on improving memory before tests. Understanding the connection between sleep and memory is crucial, as academic achievement relies on the ability to retain information. The study examines various sleep phases, emphasizing the functions of REM and NREM sleep in memory processing. It also examines declarative and procedural memory consolidations while sleeping, emphasizing the significance of different sleep phases for memory preservation. The relationship between sleep quality and test performance is demonstrated through empirical research on sleep and memory consolidation. The harmful effects of lack of sleep on memory recall emphasize the need for quick counselling interventions to help students with memory-related issues before tests. Counselling treatments include relaxation exercises, sleep hygiene instruction, and cognitive-behavioral therapies. Sleep hygiene instruction aims to establish reliable sleep routines and create a sleep-friendly atmosphere. Cognitive-behavioural therapies focus on sleep disorders and unfavourable views about memory and sleep. Memory improvement therapy emphasizes ethical issues and client autonomy. Case studies demonstrate how counselling techniques can be used in real-world settings to help students struggling with sleep or memory. Future research should examine individual variations in the link between sleep and memory and assess the efficiency of long-term counselling. Counsellors can play a key role in boosting academic performance and well-being by prioritizing sleep education and adopting evidence-based treatments. Further study in this area is expected to unlock the full potential of sleep as a crucial element in cognitive function and academic achievement.*

**Keywords**: Sleep Patterns, Memory Consolidation, Memory Enhancement, Counseling Strategies, Academic Performance, Sleep Hygiene, Cognitive-Behavioral Interventions

## Introduction

Since ancient times, scientists have studied sleep and its many causes and purposes. With groundbreaking research like those by Hermann Ebbinghaus on the connection between sleep and memory retention, sleep's involvement in memory consolidation gained traction in the late 19th and early 20th centuries (Boyce et al., 2017). The relationship between sleep and memory processes has been more well understood due to developments in neuroscience and technology (Schönauer, 2018). The ability to recall information is essential for academic success. For students to succeed in tests, schoolwork, and general learning, they must be able to consolidate and remember the knowledge they have gained in class. Students with healthy memories can better retain and apply information, improving their academic achievement and fostering a deeper comprehension of the topics (Strauss et al., 2022; McDevitt et al., 2015).

Teachers and counsellors have seen a spike in students who struggle with memory recall at test times in recent years. Increased academic pressure, information overload, insufficient study skills, and lifestyle changes that affect sleep quality are some causes of this problem (Guan et al., 2020). Given the importance of memory consolidation for academic performance, there is an urgent demand for counselling techniques that help improve memory before tests. Targeted therapies may help students better manage their sleep patterns and memory functions as they deal with different stresses and diversions, eventually improving their test performance and general well-being (Hu et al., 2020). This study aims to significantly advance our understanding of the intricate connection between sleep patterns and memory consolidation. It attempts to shed light on how sleep affects memory functions and how this information can be successfully implemented by integrating research results with counselling tactics. For students' academic success and general well-being, it might be important to understand the relationship between sleep and memory consolidation (Alordiah, 2022; Alordiah, 2020; Boyce et al., 2017). This study may assist students in increasing their memory recall, lessening exam-related stress, and improving their overall learning experience by providing useful counselling tools. The investigation of the complex connection between sleep habits and memory consolidation is the main goal of this research. It will examine how various sleep phases affect this cognitive function and the neurobiological mechanisms driving memory consolidation during sleep. These treatments will include a variety of techniques, such as cognitive-behavioral therapy, relaxation techniques, sleep monitoring, and evaluation.

To thoroughly examine the subject, the work is divided into several parts. The structure is Sleep and Memory Consolidation, Memory-Boosting Counseling Techniques, Ethical Considerations for Memory-Boosting, Case Studies and Practical Application, Future Directions, and Research Opportunities. To further the fields of sleep, memory, and counselling, the article will close with a discussion of prospective future research paths. This will include looking at new areas of study and prospects.

## Sleep Patterns and Memory Consolidation

### Definition of Sleep Patterns

The many cycles and repeated sequences of sleep phases people go through on a regular night's rest are called sleep patterns. The circadian rhythm, the body's intrinsic biological clock, and outside elements, including lifestyle, habits, and environmental circumstances, impact these patterns (Blunden et al., 2019). Rapid Eye Movement (REM) sleep and Non-Rapid Eye Movement (NREM) sleep are the two main types of sleep. The three NREM sleep phases are N1, N2, and N3 (Deliens et al., 2013). Each stage has unique qualities, and a full sleep cycle usually consists of all of them in the following order:

1. The shortest stage of sleep, Stage N1 (NREM 1), is when alertness and sleep are separated. People may have wandering thoughts or short, fragmented dreams during this phase, typically lasting a few minutes (Lee et al., 2016).
2. Stage N2 (NREM 2): The body gets ready for deep sleep during this stage. The body temperature drops and the respiration and heart rate calm down. Sleep spindles and K-complexes, rhythmic brain waves, may be seen in bursts during brain activity (Perrault et al., 2019).

3. The most vital stage of sleep is Stage N3 (NREM 3), often known as slow-wave or deep sleep. Delta waves, which are sluggish brain waves, are its defining feature. The body boosts its immune system, heals tissues, and encourages deep sleep development (van der Meij et al., 2019).
4. Vigorous Eye Movement (REM) REM sleep is linked to vivid dreams, quick eye movements, elevated brain activity, and paralysis of the muscles (to prevent acting out dreams). This phase is essential for regulating emotions, consolidating memories, and cognitive processes (Miller et al., 2019).

The sleep cycle's N1, N2, N3, and REM phases normally occur in that sequence. A whole cycle lasts between 90 and 120 minutes; on average, a person goes through many sleep cycles in one night. Age, individual characteristics, and other variables may affect the distribution and percentage of each stage within the sleep cycles (Wei et al., 2018). Numerous variables, such as age, stress, lifestyle, sleep problems, and job schedules, may affect sleep patterns. Promoting regular and restorative sleep patterns requires maintaining a consistent sleep schedule, providing a relaxing atmosphere for sleep, and forming good sleep habits (Solomonova et al., 2020).

**The Neurobiology of Memory Consolidation During Sleep**

The processing of memories mostly takes place in the hippocampus and neocortex of the brain. New memory encoding and beginning memory storage depend on the hippocampus, a region in the medial temporal lobe. The hippocampus aids in the transmission of recent memories to the neocortex, the part of the brain responsible for long-term memory preservation, when a person is awake. Memory may be incorporated into existing knowledge networks because of the neocortex's abundance of association regions skilled at processing various forms of information (Singh et al., 2022).

Memory consolidation, or solidifying and preserving memories created while awake, depends heavily on sleep. "Hippocampal replay" is the process through which the hippocampus replicates the neuronal firing patterns from the previous day while under non-rapid eye movement (NREM) sleep. The replay mechanism is essential for sending memories to the neocortex. The brain's activity during REM sleep mirrors learning patterns, suggesting that this stage is crucial in further solidifying memories, particularly those with emotional meaning (Singh et al., 2022; Ruch et al., 2020; Wei et al., 2018).

**Memory Consolidation Techniques**

Learning and retaining motor habits and skills are both parts of procedural memory. Procedural memories may be seen in actions like riding a bike or playing an instrument. Sleep, especially NREM Stage 2 and REM sleep, is believed to improve procedural memory consolidation. To boost performance after sleep, the brain organizes and fortifies the neural connections made during skill learning (Solomonova et al., 2020).

Declarative memory is the conscious recollection of events, facts, and knowledge. It may also be separated into episodic and semantic memory (general knowledge) (personal experiences). Declarative memory consolidation especially depends on NREM slow-wave sleep (NREM Stage 3). Better retention and memory are encouraged by the brain's ability to restructure and integrate new information with old memories during this deep sleep period (Qian et al., 2022; Naji et al., 2018).

**The Role of Sleep Stages in Memory Processing**

Memory consolidation is influenced individually by various sleep phases. Declarative memory consolidation is correlated with NREM slow-wave sleep (NREM Stage 3), while procedural memory consolidation depends heavily on NREM Stage 2 and REM sleep. These sleep phases help with knowledge retention and retrieval by converting unstable, short-term memories into more stable, long-term memories (Hu et al., 2020).

Sleep disturbances, including sleep deprivation, interrupted sleep, or disorders like insomnia, may greatly impact memory consolidation. In particular, declarative memory retention has been associated with lower NREM slow-wave sleep. Additionally, decreased procedural memory consolidation has been linked to REM sleep interruptions. A lack of sleep may interfere with the brain's memory consolidation processes, reducing learning effectiveness and lowering test performance. For successful counselling tactics to improve memory before tests, it is essential to comprehend how sleep phases and memory processing interact (Lipinska et al., 2019).

**Counselling Strategies for Enhancing Memory Before Examinations**

**Sleep Hygiene Education**

1. Establishing a Consistent Sleep Schedule

Counsellors should inform kids of the value of adhering to a regular sleep pattern, which helps them align their internal circadian cycles. Even on weekends, going to bed and getting up simultaneously daily may promote memory consolidation and improve sleep quality.

Counsellors should provide helpful advice for developing a consistent sleep schedule, including setting bedtime reminders, coming up with calming pre-sleep routines, and avoiding significant changes in sleep schedules (Baranwal et al., 2023).

2. Creating a Sleep-Friendly Environment

Students should be taught how to set up a bedroom conducive to sleep. This entails maintaining a cool, calm, dark sleeping environment and spending money on comfortable mattresses and pillows. Counsellors should go through methods for reducing outside disturbances, including using earplugs or white noise machines and blackout curtains to block out light, which may enhance the consistency and general quality of one's sleep (Caddick et al., 2018).

3. Avoiding Stimulants and Electronics Before Bed

Caffeine use close to bedtime has negative consequences that students should discuss since it might interfere with their sleep cycles. Counsellors will also review the detrimental effects of blue light emissions from electronic devices (such as smartphones and laptops) on sleep quality.

Counsellors will collaborate with children to create individualized programs for reducing stimulant use, limiting coffee intake, and instituting screen-free periods before bed to promote sleep hygiene (Christensen et al., 2016).

**Relaxation Techniques for Better Sleep**

1. Mindfulness Meditation

Counsellors need to discuss mindfulness meditation with pupils to unwind, which may lower tension before bed, and practice mindfulness activities before sleep, promoting relaxation and a peaceful state of mind. They can do this to encourage sound sleep. They should describe how mindfulness exercises may help people divert their attention from troubling thoughts and make it

easier to fall asleep. Counsellors may assist students in person or via recorded sessions (Solomonova et al., 2020).

2. Progressive Muscle Relaxation

To alleviate physical stress and promote relaxation, counsellors should teach progressive muscle relaxation, which involves methodically tensing and releasing muscle groups.

The progressive muscle relaxation method should be taught to students step-by-step so they may practice it on their own to relax before bed (Özlü et al., 2021).

3. Breathing Exercises

Counsellors will instruct students in various breathing techniques, including diaphragmatic and 4-7-8 breathing, to help them relax and prepare for bed (Aboussouan et al., 2017).

Including deep breathing exercises in a pre-sleep routine: To unwind their bodies and minds before bed, students should be encouraged to include deep breathing exercises in their pre-sleep routine (Aboussouan et al., 2017).

**Cognitive-Behavioral Interventions**

1. Identifying and Addressing Sleep Disturbances

Counselors should work with students to recognize typical sleep disorders such as insomnia, restless legs syndrome, and sleep apnea and discuss how these may affect memory encoding and general well-being. Counsellors should provide tailored therapies based on the reported sleep difficulties, including relaxation exercises, sleep restriction therapy, or referral to sleep experts for further assessment (Klingaman et al., 2015).

2. Challenging Maladaptive Sleep Beliefs

Students should examine their attitudes and ideas on memory consolidation and sleep. Counsellors will assist in identifying any maladaptive thoughts that can make it difficult for them to develop sound sleeping patterns (Yang et al., 2014). To create good attitudes and beliefs that support sound sleep patterns, counsellors should employ cognitive restructuring strategies to assist students in challenging and replacing false or unrealistic views about sleep.

3. Promoting Positive Sleep Attitudes

Students should be inspired to embrace sleep via counselling sessions, understanding its critical function in memory encoding, cognitive function, and general well-being. Counsellors can stress how getting enough sleep helps with memory consolidation and how changing one's sleeping patterns may help students perform better in class and be ready for exams.

**Implementing Sleep Monitoring and Assessment**

1. Sleep Diaries and Tracking Sleep Patterns

Counsellors will instruct students on the advantages of keeping a sleep diary to monitor their sleep habits, daily schedules, and other elements that could impact their sleep quality. Students may make educated judgments about their sleep habits by evaluating the data from their sleep diaries to obtain insights into their sleep patterns, spot trends, and find areas for growth (Blagrove et al., 2011).

2. Using Sleep Monitoring Devices and Apps

Counsellors can educate children about sleep trackers and smartphone apps that monitor sleep habits and provide factual information on sleep length, stages, and interruptions. The benefits and

drawbacks of employing technology for sleep monitoring should be discussed by counsellors, who should also stress the significance of interpreting data in light of clients' experiences and emotions (Quante et al., 2019).

3. Identifying and Addressing Sleep Irregularities

Counsellors will work with students to design individualized plans to manage sleep irregularities based on individual experiences and sleep data to enhance memory consolidation and sleep habits (Kjaerby et al., 2022). Counselors will stress the need for tailored counseling techniques to treat particular sleep abnormalities and successfully increase memory consolidation since they know everyone has different sleep demands.

**Ethical Considerations in Memory Enhancement Counseling**

**The Ethics of Sleep Aids and Medications**

Memory improvement therapy may recommend sleeping pills or other drugs to increase sleep quality and memory consolidation. Counsellors will have a full conversation with clients on the moral ramifications of using sleeping pills. They will talk about the client's medical background, possible drug combinations, and the suitability of sleep aids depending on specific requirements (Boyce et al., 2016). Counsellors will consider better sleep quality and memory consolidation advantages while recommending sleep medicines. They will concurrently evaluate the related risks, such as side effects, dependence, and possible harmful interactions. The client's preferences and safety concerns will be considered when deciding whether to utilize sleep medicines (Shaikh, 2020).

**Techniques for Memory Enhancement: Potential Hazards**

Counselling for memory improvement may entail advising different methods and strategies to boost memory consolidation. The possible dangers and negative impacts of these techniques will be fully discussed with clients by counsellors. For instance, some cognitive or relaxation methods may have emotional or psychological impacts that must be considered (Hu et al., 2020). While improving memory is a desired objective, counsellors will stress the need to weigh the potential advantages with any potential drawbacks or unforeseen effects. The strategy will put the client's general well-being first, ensuring that memory-improving techniques are used sensibly and safely (Strauss et al., 2022).

**Ensuring Informed Consent and Client Autonomy**

Before using memory improvement therapy techniques, counsellors will obtain the client's informed permission. Giving complete information about the counselling process, its risks and benefits, and accessible options is necessary for informed consent. Clients must be allowed to inquire about and make choices about participating in therapies for memory improvement (Perni et al.,2019). Clients have a right to autonomy when making choices concerning their sleep-related therapies. Counsellors will respect the decisions and preferences of their clients, acknowledging that everyone has different needs and comfort levels. Customers should feel empowered to make decisions by freely expressing their worries, objectives, and expectations (Perni et al.,2019). The principles of beneficence (working in the client's best interest) and non-maleficence must be followed while providing memory improvement coaching (avoiding harm). Counsellors will carefully assess the moral ramifications of memory-improving techniques, ensuring treatments are suited to the requirements and ethics of each client. To ensure clients' well-being looking to

improve their memory before tests, the ethical issues in memory enhancement counselling emphasize the significance of client-centred care, safety, and informed decision-making (Nelwan et al., 2018).

**Case Studies and Practical Application**

**Case Study 1: Counseling a Student Struggling with Sleep and Memory**

1. A university student has sleep and memory consolidation issues in this case study. The student reports having inconsistent sleeping habits, frequent sleep interruptions brought on by stress, and insufficient sleep length, which results in weariness and poor memory consolidation. The student's memory issues show up as forgetfulness during tests and trouble remembering material covered in class (Strauss et al., 2022).
2. The development and execution of counselling solutions start with a comprehensive evaluation of the student's sleeping patterns, way of life, and sources of academic stress. The counsellor creates a unique strategy for each client based on the evaluation that includes: (Boyce et al., 2017).
    - Setting up a reliable sleep schedule: The student receives instruction on the value of consistent sleep and waking periods and advice on how to do it.
    - To assist the student in managing pre-sleep anxiety and encourage improved sleep quality, relaxation methods include mindfulness meditation and progressive muscle relaxation exercises.
    - Cognitive-behavioural interventions: The counsellor assists the student in identifying and resolving sleep issues and erroneous ideas about memory and sleep.
    - Sleep monitoring: The student is encouraged to keep a sleep diary to track sleep patterns, which provides valuable data for further adjustments.
3. Evaluation of the treatments' efficacy: The student practices the counselling techniques over many weeks. The counsellor routinely gauges the student's development through follow-up sessions and measures sleep habits, memory function, and general well-being changes. The therapies' efficacy is assessed using subjective input from the student and objective metrics such as increased sleep length and efficiency (Strauss et al., 2022).

**Case Study 2: Implementing Counseling Strategies in an Academic Setting**

1. Integrating memory enhancement counselling in educational institutions: This case study involves implementing memory enhancement counselling within an academic setting, such as a university's counselling centre. The counselling centre collaborates with faculty, administrators, and other support services to create a holistic approach to student well-being (Schwitzer et al., 2018).
2. Supporting students' sleep and memory via collaboration with educators and administrators: The counselling centre works with educators to improve awareness of the value of sleep and its effect on memory consolidation. The use of flexible deadlines and avoiding early test times are only two sleep-friendly teaching strategies that the administration promotes. Administrators support the project by providing tools for sleep instruction and fostering a school culture that prioritizes good sleep habits (Hu et al., 2020).
3. How to gauge how counselling affects kids' academic performance: Students who have undergone memory improvement therapy are monitored academically by the counselling

facility. Exam results, GPA, and other academic statistics are included in this data. The counselling centre may evaluate the effects of the interventions on students' test scores and general academic accomplishment by contrasting the academic performance of students who engaged in counselling with those who did not (AlFakhri et al., 2015).

**Case Study 3: Adapting Strategies for Different Student Profiles**

1. Counselling strategies adapted to the varied student populations: The counselling centre serves various students with varied sleep and memory issues in this case study. Counselling approaches are designed to meet various pupils' particular requirements and preferences, considering elements like age, cultural background, and personal learning preferences (Ardura et al., 2020).
2. Addressing certain difficulties and situations in memory improvement counselling: The counselling centre works with students in various situations, such as overseas students experiencing jet lag, athletes with unpredictable training schedules, or students with sleep-related medical disorders. To provide complete assistance and accommodations, the counselling staff works with other university resources, such as the foreign student services or sports departments (Boyce et al., 2017).
3. Results and lessons learned from customized interventions: The counselling centre obtains important knowledge about the efficacy of different counselling tactics by recording the results and feedback from individualized interventions. To better serve the varied student groups, this data is utilized to improve memory improvement therapy continuously (Hudes et al., 2019).

The case studies show how memory improvement therapy may be used in practical ways in everyday situations. Memory enhancement counseling can help students improve their sleep patterns and memory consolidation through individualized interventions, collaboration with educational institutions, and a dedication to ethical practices. This will ultimately improve their academic performance and well-being before exams.

**Future Directions and Research Opportunities**

**Advancements in Sleep Science and Memory Research**

1. Future sleep and memory consolidation research will focus on understanding the interaction between NREM and REM sleep phases, memory processes and learning outcomes, memory systems affected by sleep length, quality, and sleep interruptions, and the possible reciprocal link between sleep and memory. Technological advancements will enable new methods and tools to investigate memory and sleep consolidation, such as neuroimaging, real-time monitoring, and sleep-specific therapies.
2. Additionally, studies could examine individual variations in sleep-memory relationships, such as age, gender, genetics, and personality features, and their impact on memory consolidation. This could lead to developing individualized memory improvement techniques that adapt counselling methods to individual qualities and characteristics.
3. Long-term research is necessary to determine the sustainability of benefits in memory consolidation and academic results. Longitudinal studies should evaluate the risks and benefits of long-term memory-enhancing interventions, ensuring the well-being of individuals seeking to improve their memory.

**Implications of this study to counsellors**

1. Counsellors should understand the neurobiological processes of memory consolidation during sleep to effectively handle memory-related issues.
2. Counsellors emphasize sleep hygiene for students, emphasizing the importance of restorative sleep for improved memory and academic performance.
3. Individualized therapy solutions for sleep and memory issues require analyzing clients' habits, stress levels, and lifestyle variables.
4. To lessen pre-sleep anxiety and encourage improved sleep quality, counsellors might use relaxation methods like progressive muscle relaxation and mindfulness meditation. Clients who get this instruction can control their stress and improve memory retention.
5. Cognitive-behavioural therapy helps counsellors treat sleep disorders, dispel false beliefs, and promote healthy habits and memory.
6. Counsellors must ensure clients understand memory-improving techniques, ethical issues, informed consent, and client autonomy.
7. Counsellors collaborate with educational institutions to incorporate memory improvement therapy, promote sleep-related academic performance, and foster a supportive environment.
8. Examining the long-term benefits of memory improvement therapy on academic achievement and retention is crucial. The long-term advantages of counselling therapies may be better understood via longitudinal investigations.
9. It is crucial to assess how memory retention and academic performance change over time due to memory improvement coaching. Longitudinal studies may provide insightful information on the long-term advantages of counselling therapies.
10. Counsellors must be able to distinguish between individual variations in sleep-memorization connections. When counselling different student groups, interventions are more successful and tailored to individual requirements.

**Conclusion**

This theoretical article investigates the relationship between sleep habits and memory consolidation and provides insightful advice on sharpening memory before tests. It emphasizes how important sleep is for memory consolidation and academic success, laying the groundwork for evidence-based therapies. The research investigates the neurobiological underpinnings of declarative and procedural memory consolidation during sleep, differentiating between NREM and REM sleep phases and the kinds of memory consolidation. The relevance of relaxation methods, cognitive-behavioural therapies, and ethical issues in memory improvement counselling is emphasized in the article. The case studies show how these methods may help students with trouble sleeping or remembering things. By emphasizing individual variations and assessing the long-term impacts of counselling treatments, the report suggests prospective research possibilities to enhance sleep science and memory research. Counsellors may assist people in enhancing their memory before tests and thriving academically and emotionally by prioritizing sleep education, applying evidence-based therapies, and upholding ethical practices.

**References**

Aboussouan, L. S., & Mireles-Cabodevila, E. (2017). Sleep-Disordered Breathing in Neuromuscular Disease. *Chest*, *152*(4), 880–892. https://doi.org/https://doi.org/10.1016/j.chest.2017.03.023

AlFakhri, L., Sarraj, J., Kherallah, S., Kuhail, K., Obeidat, A., & Abu-Zaid, A. (2015). Perceptions of pre-clerkship medical students and academic advisors about sleep deprivation and its relationship to academic performance: a cross-sectional perspective from Saudi Arabia. *BMC Research Notes*, *8*(1). https://doi.org/https://doi.org/10.1186/s13104-015-1755-y

Alordiah, C. O. (2020). Development and factorial validation of a well-being scale for the nigerian child. *Journal of the Nigerian Council of Educational Psychologists, 13*(1), 1-12.

Alordiah, C. O. (2022). An examination of the latent constructs in a well-being scale for children: Application of Rasch Model. *University of Delta Journal of Contemporary Studies in Education, 1*(2), 39-57.

Ardura, D., Zamora, Á., & Pérez-Bitrián, A. (2020). The role of motivation on secondary school students' causal attributions to choose or abandon chemistry. *Chemistry Education Research and Practice*. https://doi.org/10.1039/d0rp00168f.

Boyce, R. D., Williams, S., & Adamantidis, A. R. (2017). REM sleep and memory. *Current Opinion in Neurobiology*, *44*, 167–177. https://doi.org/https://doi.org/10.1016/j.conb.2017.05.001

Baranwal, N., Yu, P. K., & Siegel, N. S. (2023). Sleep physiology, pathophysiology, and sleep hygiene. *Progress in Cardiovascular Diseases*, *77*, 59–69. https://doi.org/https://doi.org/10.1016/j.pcad.2023.02.005

Blunden, S., Magee, C., Clarkson, L., Searle, A., Banks, S., & Olds, T. (2019). Interindividual and intraindividual variability in adolescent sleep patterns across an entire school term: A pilot study.. *Sleep health*. https://doi.org/10.1016/j.sleh.2019.08.002.

Blagrove, M., Fouquet, N., Henley-Einion, J., Pace-Schott, E. F., Davies, A., Neuschaffer, J. L., & Turnbull, O. H. (2011). Assessing the Dream-Lag Effect for REM and NREM Stage 2 Dreams. *PLOS ONE*, *6*(10), e26708–e26708. https://doi.org/https://doi.org/10.1371/journal.pone.0026708

Christensen, M., Bettencourt, L., Kaye, L., Moturu, S., Nguyen, K., Olgin, J., Pletcher, M., & Marcus, G. (2016). Direct Measurements of Smartphone Screen-Time: Relationships with Demographics and Sleep. *PLoS ONE*, *11*. https://doi.org/10.1371/journal.pone.0165331

Caddick, Z., Gregory, K., Arsintescu, L., & Flynn-Evans, E. (2018). A review of the environmental parameters necessary for an optimal sleep environment. *Building and Environment*, *132*, 11-20. https://doi.org/10.1016/J.BUILDENV.2018.01.020

Deliens, G., Leproult, R., Neu, D., & Peigneux, P. (2013). Rapid Eye Movement and Non-Rapid Eye Movement Sleep Contributions in Memory Consolidation and Resistance to Retroactive Interference for Verbal Material. *Sleep*, *36*(12), 1875–1883. https://doi.org/https://doi.org/10.5665/sleep.3220

Guan, Q., Hu, X., Ma, N., He, H., Duan, F., Li, X., Luo, Y., & Zhang, H. (2020). Sleep Quality, Depression, and Cognitive Function in Non-Demented Older Adults.. *Journal of Alzheimer's disease* : JAD. https://doi.org/10.3233/JAD-190990.

Hu, X., Cheng, L. C., Chiu, M. C., & Paller, K. A. (2020). Promoting memory consolidation during sleep: A meta-analysis of targeted memory reactivation. *Psychological Bulletin*, *146*(3), 218–244. https://doi.org/https://doi.org/10.1037/bul0000223

Hudes, R., Rich, J., Troyer, A., Yusupov, I., & Vandermorris, S. (2019). The impact of memory-strategy training interventions on participant-reported outcomes in healthy older adults: A systematic review and meta-analysis. *Psychology and aging*, *34* 4, 587-597. https://doi.org/10.1037/pag0000340.

Kjaerby, C., Andersen, M., Hauglund, N. L., Untiet, V., Dall, C., Sigurdsson, B., Ding, F., Feng, J., Li, Y., & Weikop, P. (2022). Memory-enhancing properties of sleep depend on the

oscillatory amplitude of norepinephrine. *Nature Neuroscience*, *25*(8), 1059–1070. https://doi.org/https://doi.org/10.1038/s41593-022-01102-9

Klingaman, E., Palmer-Bacon, J., Bennett, M., & Rowland, L. (2015). Sleep Disorders Among People With Schizophrenia: Emerging Research. *Current Psychiatry Reports, 17*, 1-8. https://doi.org/10.1007/s11920-015-0616-7.

Lee, M. D., Katsuyama, Â. M., Duge, L. S., Sriram, C., Krushelnytskyy, M., Kim, J. J., & de la Iglesia, H. O. (2016). Fragmentation of Rapid Eye Movement and Nonrapid Eye Movement Sleep without Total Sleep Loss Impairs Hippocampus-Dependent Fear Memory Consolidation. *Sleep*, *39*(11), 2021–2031. https://doi.org/https://doi.org/10.5665/sleep.6236

Lipinska, G., & Thomas, K. V. (2019). Rapid eye movement fragmentation, not slow-wave sleep, predicts neutral declarative memory consolidation in posttraumatic stress disorder. *Journal of Sleep Research*, *28*(6). https://doi.org/https://doi.org/10.1111/jsr.12846

McDevitt, E. A., Duggan, K. A., & Mednick, S. C. (2015). REM sleep rescues learning from interference. *Neurobiology of Learning and Memory*, *122*, 51–62. https://doi.org/https://doi.org/10.1016/j.nlm.2014.11.015

Miller, K. E., & Gehrman, P. R. (2019). REM Sleep: What Is It Good For? *Current Biology*, *29*(16), R806–R807. https://doi.org/https://doi.org/10.1016/j.cub.2019.06.074

Naji, M., Krishnan, G. P., McDevitt, E. A., Bazhenov, M., & Mednick, S. C. (2019). Coupling of autonomic and central events during sleep benefits declarative memory consolidation. *Neurobiology of Learning and Memory*, *157*, 139–150. https://doi.org/https://doi.org/10.1016/j.nlm.2018.12.008

Nelwan, M., Vissers, C., & Kroesbergen, E. (2018). Coaching positively influences the effects of working memory training on visual working memory as well as mathematical ability. *Neuropsychologia*, *113*, 140-149. https://doi.org/10.1016/j.neuropsychologia.2018.04.002

Özlü, İ., Öztürk, Z., Özlü, Z. K., Tekin, E., & Gur, A. (2021). The effects of progressive muscle relaxation exercises on the anxiety and sleep quality of patients with COVID-19: A randomized controlled study. *Perspectives in Psychiatric Care*, *57*(4), 1791–1797. https://doi.org/https://doi.org/10.1111/ppc.12750

Perrault, A. A., Khani, A., Quairiaux, C., Kompotis, K., Franken, P., Muhlethaler, M., Schwartz, S., & Bayer, L. (2019). Whole-Night Continuous Rocking Entrains Spontaneous Neural Oscillations with Benefits for Sleep and Memory. *Current Biology*, *29*(3), 402-411.e3. https://doi.org/https://doi.org/10.1016/j.cub.2018.12.028

Perni, S., Rooney, M., Horowitz, D., Golden, D., McCall, A., Einstein, A., & Jagsi, R. (2019). Assessment of Use, Specificity, and Readability of Written Clinical Informed Consent Forms for Patients With Cancer Undergoing Radiotherapy. *JAMA oncology*, e190260. https://doi.org/10.1001/jamaoncol.2019.0260.

Qian, L., Ru, T., He, M., Li, S.-Y., & Zhou, G. (2022). Effects of a brief afternoon nap on declarative and procedural memory. *Neurobiology of Learning and Memory*, *194*, 107662–107662. https://doi.org/https://doi.org/10.1016/j.nlm.2022.107662

Ruch, S., & Henke, K. (2020). Learning During Sleep: A Dream Comes True? *Trends in Cognitive Sciences*, *24*(3), 170–172. https://doi.org/https://doi.org/10.1016/j.tics.2019.12.007

Shaikh, Z. F. (2020). Sleep medicine and the cardiologist. *Heart*, *106*(11), 864–865. https://doi.org/https://doi.org/10.1136/heartjnl-2019-316027

Strauss, M., Griffon, L., Van Beers, P., Elbaz, M., Bouziotis, J., Sauvet, F., Chenaoui, M., Leger, D., & Peigneux, P. (2022). Order matters: sleep spindles contribute to memory consolidation only when followed by rapid-eye-movement sleep. *Sleep*, *45*(4). https://doi.org/https://doi.org/10.1093/sleep/zsac022

Quante, M., Khandpur, N., Kontos, E., Bakker, J., Owens, J., & Redline, S. (2019). A Qualitative Assessment of the Acceptability of Smartphone Applications for Improving Sleep Behaviors

in Low-Income and Minority Adolescents. *Behavioral Sleep Medicine, 17*, 573 - 585. https://doi.org/10.1080/15402002.2018.1432483.

Schönauer, M. (2018). Sleep Spindles: Timed for Memory Consolidation. *Current Biology*, *28*(11), R656–R658. https://doi.org/https://doi.org/10.1016/j.cub.2018.03.046

Solomonova, E., Dubé, S., Blanchette-Carrière, C., Sandra, D. A., Samson-Richer, A., Carr, M., Paquette, T., & Nielsen, T. (2020). Different Patterns of Sleep-Dependent Procedural Memory Consolidation in Vipassana Meditation Practitioners and Non-meditating Controls. *Frontiers in Psychology*, *10*. https://doi.org/https://doi.org/10.3389/fpsyg.2019.03014

Schwitzer, A., Moss, C., Pribesh, S., John, D., Burnett, D., Thompson, L., & Foss, J. (2018). Students With Mental Health Needs: College Counseling Experiences and Academic Success. *Journal of College Student Development, 59*, 20 - 3. https://doi.org/10.1353/csd.2018.0001.

Singh, D., Norman, K. A., & Schapiro, A. C. (2022). A model of autonomous interactions between hippocampus and neocortex driving sleep-dependent memory consolidation. *Proceedings of the National Academy of Sciences of the United States of America*, *119*(44). https://doi.org/https://doi.org/10.1073/pnas.2123432119

van der Meij, J., Martinez-Gonzalez, D., Beckers, G. J. L., & Rattenborg, N. C. (2019). Intra-"cortical" activity during avian non-REM and REM sleep: variant and invariant traits between birds and mammals. *Sleep*, *42*(2). https://doi.org/https://doi.org/10.1093/sleep/zsy230

Wei, Y., Krishnan, G. P., Komarov, M., & Bazhenov, M. (2018). Differential roles of sleep spindles and sleep slow oscillations in memory consolidation. *PLOS Computational Biology*, *14*(7), e1006322–e1006322. https://doi.org/https://doi.org/10.1371/journal.pcbi.1006322

Yang, C.-M., Hung, C.-Y., & Lee, H. C. (2014). Stress-Related Sleep Vulnerability and Maladaptive Sleep Beliefs Predict Insomnia at Long-Term Follow-Up. *Journal of Clinical Sleep Medicine*, *10*(09), 997–1001. https://doi.org/https://doi.org/10.5664/jcsm.4036