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From ZZZ's to A's: How Your Sleep Cycle Affects How You Study

Audrey L. Crippin

Abstract: Studying and sleeping are two essential parts of succeeding in an academic setting. The expression “the early bird gets the worm” suggests that people who wake up early garner more success in life. But why? This paper looks into the effect of a person’s chronotype (if you’re a morning person or an evening person) on study techniques and academic success. There are many different ways to study and comprehend material, with different techniques being most beneficial during different times of day. If you’ve ever felt like a study technique that works great for a friend is impossible for you to do, it may in part be related to your Morningness-Eveningness Questionnaire score. This paper will explore the circadian rhythm, morning and evening type students, and study techniques that work best for varying personalities.

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Humans function on a 24-hour biological cycle called circadian rhythm. This series is dependent on light-dark sequences and plays an important role in regulating sleep times, body temperature, hormones, and alertness.¹ The circadian rhythm has two main subcategories: morning-type and evening-type. These can be viewed as a spectrum; a person can fall anywhere from an extreme morning-type to an extreme evening-type with most of the population somewhere in-between. These groups can be expressed as chronotypes, which are the behavioral manifestations of the biological differences between the two types of people.¹ These behavioral differences can influence how one chooses to handle certain situations as well as when one is most productive during the day. College students have some of the most unpredictable schedules, and many struggle to find effective study techniques. Applying the science behind chronotypes to different study techniques allows for students to optimize their time when preparing for an exam.

The circadian clock is believed to be situated at the base of the hypothalamus within the brain.² The scientific research behind the circadian clock began within the last several years. The current model suggests that two genes, Period (Per) and Cryptochrome (Cry), regulate the 24-hour cycle. The circadian rhythm has a hormonal chemical nature, which drives the release of melatonin and cortisol.² Melatonin is a hormone secreted at night and is responsible for effective sleep and rhythm in the circadian cycle.² This cycle regulates many of the body’s processes. Differences within cycle start time create the subtypes of morning-type and evening-type. In 1976, Horne & Ostberg developed The Morningness-Eveningness Questionnaire (MEQ): a method to determine if one was a morning-type or evening-type.³ Morning-types have melatonin rhythms that occur earlier in the day than evening-types.³ This results in an “early to bed, early to rise” mindset for morning types, which causes them to reach peak melatonin levels earlier, resulting in an earlier wake time. Whereas evening types reach peak productivity later in the day due to a later release of melatonin, resulting in a later wake time. Light exposure, both indoor and outdoor, also influences regulation of the circadian cycle. Morning types are exposed to outdoor light earlier and for longer periods of time

while evening-types are subjected to light later in the day and are exposed to indoor light for a longer duration.³ The sleep-wake pattern managed by the circadian rhythm can play a major role in determining time of day for peak productivity and should be a major consideration when working on tasks.

Chronotypes, when applied to students, can give insight into study habits and optimal times to study. Initially, morning-type students seem to have the best advantage. Students with a more regular sleep cycle and greater sleep duration demonstrated better academic performance.⁴ Finding a structured schedule within the academic and social challenges of college can be a struggle that many students face. Studies have shown that keeping a schedule with regular waking times and repetitive habits is associated with morning-type rhythm. Morning-type students may cope better with the early start of school schedules. Morning-type students benefit more conventionally from their chronotype. Evening-type students face more challenges, but this discrepancy creates greater life management skills. One study suggests that evening-type students may have increased problem solving abilities as they are constantly being challenged by their schedules, which are often biased towards morning-type personalities.⁵ While some evening-type students may be able to customize their class schedule to start later, other students may not have that option. For evening-type students who may have a school schedule that’s not favorable to their circadian rhythm, it would be beneficial to place a greater emphasis on regularity in life.

Grades, like schedules, are also influenced by type of student. There is a negative relationship between academic grading and MEQ score. Evening-types have shown to have lower school performance.⁶ Students perform best in correlation to their optimal times of day.⁷ In one study, morning-type students were shown to have a higher final exam score than those students who were identified as evening-type.⁸ Most exams are given in the morning, placing morning-type students at an advantage. One proposed theory behind the negative association between MEQ scores and test scores is self-control. Evening-types are associated with poorer self-control.⁹ These individuals when given the choice to stay in and study or go out with friends

the night before an exam would choose the latter. Poor self-control is associated with impulse decisions and an inability to stay focused on tasks while studying. This suggests that evening-type students' grades may not only be affected by the exam administration time, but also their study habits prior to the exam.

Multiple studies have been done in an attempt to understand the psychological makeup of different chronotypes and how it affects an individual's habits. One study indicated that napping occurred more frequently in higher performing students.¹⁰ For morning-type students, it might be beneficial to take a quick nap if late-evening studying is necessary. Another study showed a dip in their performance right after lunch.¹¹ While it might not always be possible, it could be beneficial to factor a nap into one's schedule. Leading up to a big exam, a morning-type person could study early, eat lunch, take a short nap, and then continue to study. This would allow them to finish studying early enough in the evening to coincide with their circadian rhythm. For an evening-type person, a nap would be most beneficial in the early evening, either before or after dinner. Evening-type students already tend to be up late, but a nap would provide them with the rest they need to be productive for the remainder of the evening. Additionally, morning students would also benefit most from tackling difficult concepts first. Morning-type brains are most alert earlier in the day and this would allow for full focus on the problem at hand.⁵ Since evening-type students are inclined to have a more difficult time with self-control, it would be beneficial to plan everything that needs to be done.¹⁰ Having a task list would allow students to stay on top of things and be less distracted. Evening-type students that have a tendency to stay up late must be mindful that sleep deprivation leads to poorer academic performance.⁹ While a last-minute cram session the night before an exam might seem like a good idea to an evening-type student because they have the ability stay awake all night, all-nighters are not recommended as they disrupt the circadian rhythm. For both morning-type and evening-type students, sleep is important as it enhances memory recall. Regardless of when studying occurs, it's best to go over information and read through notes right before falling asleep.¹² This can help improve recall during a testing situation.

Learning to study effectively is one of the biggest challenges college students face. Students must switch from surface-level learning, which is often done in high school, to a more effective form of deep-processing. Deep-processing involves creating task-specific goals while studying.¹³ Evening-type students have more issues with staying on task and creating goals; therefore utilizing organization-based study skills would be most beneficial to keep them on track. This technique involves constructing a calendar that addresses daily, weekly, and monthly studying schedules.¹⁴ When creating these schedules, evening-type students should consider the time of day they choose to study such as later in the day for better focus, allow for a variety of assignments not just taking notes for the entire study session, and allot time for breaks. Since evening-type students have been found to have better cognitive advantages,⁹ another study technique they benefit best from is cognitive-based study skills.¹⁵ This involves looking at the big picture by

creating concept maps or summarizing the information into their own words.

Morning-type students must also be conscious of their peak efficacy. Since morning-type students are more likely to have a consistent schedule, they would benefit best from studying at the same time every day to utilize time-stamp learning. It is believed that the brain puts a "time-stamp" on information that is learned, and then stores that information based on what time it was learned. The brain associates the time the information was learned with the time it may be needed for recall.¹⁶ Also, sleep helps the brain to process and sort information. For morning-type students who study before noon and then relax, incorporating the technique of rereading notes prior to bedtime will help with their memory recall.¹³ Although, it's also important for evening-type students as well, this technique is especially beneficial for morning-type students as the rest of their learning efforts occur earlier in the day. For both types of students, the most applicable study technique is to generate their own study questions.¹⁷ In a study comparing the use of teacher provided guides, teacher provided questions, student generated questions, and student generated guides, it was found that students benefitted most when they created questions about the material.¹⁷ This can be done regardless of time of day and would provide good material to review prior to bed to help with memory recall.

Chronotypes play a role in body regulation and mental function. Both morningness and eveningness provide unique benefits and challenges for students in an academic setting. Morning-type students benefit best from starting around 8 or 9 in the morning and working on the toughest material first. Evening-type students succeed best when following a consistent daily regimen. Overall, both students benefit from studying right before bedtime as this aids in memory recall. Applying different techniques in relation to each student's chronotype allows them to make the most of their studying time while tailoring it to a schedule that best works for them.

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