



The Sleep-Wake Cycle of Adolescents & School Start Times: A Review & Critical Evaluation of Available Evidence

Key Concepts

- ◆ Process C promotes wakefulness, Process S promotes sleepiness; these interact during the day and control our Sleep-Wake Cycle.
- Most adolescents display Delayed Phase Preference due to biological and social factors.
- Attention, memory, executive functioning and other cognitive abilities are influenced differently by the Sleep-Wake Cycle.
- Later school start times for secondary grades have been shown to improve sleep-debt, punctuality, attendance, behaviour, sociability and continuous enrolment, particularly for the at-risk student population.



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This literature review reports the major findings of research relevant to the changing of high school start times for the benefit of adolescent learning. It integrates what is currently understood about the sleep-wake cycle of adolescents and how it relates to an educational context.

The interaction of the two processes that influence the sleep-wake cycle (the homeostatic drive for sleep and the circadian wakeful promoting process), the cognitive correlates of these processes, and how these processes change during adolescence are examined.

It concludes that there is sufficient evidence to indicate that environmental and biological factors contribute to *delayed phase preference* (DPP) in adolescents, causing them to go to sleep later in the evening and wake up earlier in the morning than children and adults. This DPP is at odds with early school start times that require students to attend classes when they are not in an awakened stage, and depriving adolescents of much needed sleep causing them to accrue sleep-debt.

The lack of synchronicity between school start times and the circadian rhythm of adolescents, as well as the sleep debt that is accumulated as a result, have several cognitive correlates that are likely harming the academic performance of adolescent students.

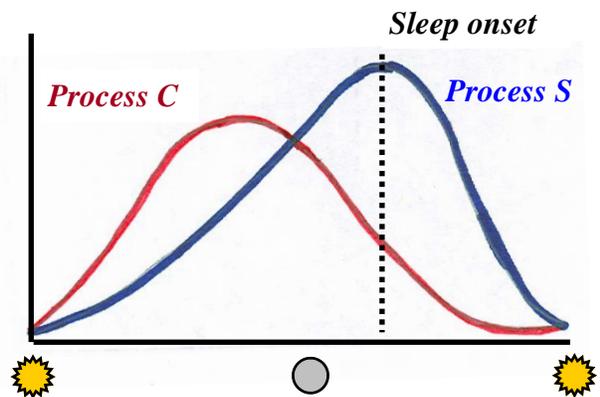
Attentional impairments, memory deficiencies, hindered executive function processes, and behavioural problems have all been shown to be associated with a lack of synchronicity between circadian rhythm and daily scheduling. These findings suggest that adolescents may benefit from a delay in school start times; in effect, more closely synchronizing the school schedule with the typical adolescent circadian rhythm.

Findings from schools that have delayed their school start times are examined, specifically the effect this schedule change on the student body. Adolescents that attended schools with later start times slept a significant amount more than their early-starting counter-parts; thus they did not accrue sleep-debt throughout the week. This increase in synchronicity and sleep-quantity was associated with improved attendance, more continuously enrolled students, less tardiness, less subjective sleepiness, improved moods and less behavioural problems.

Although statistical analysis did not reveal any significant improvements in overall letter grades, confounding variables limited the possibility of detecting improvements in grades, thereby hindering the ability to evaluate the effectiveness of changing start times on student achievement.

However, based on the aforementioned qualitative improvements in sleeping habits and behavioural correlates of academic performance, it concludes that changing school start times is a worthwhile pursuit, of which the students are the primary beneficiaries.

Finally, the various factors, including costs and complications, that have been associated with implementing a delay in start times are reviewed. By examining previous school districts that have successfully delayed start times, it concludes that the potentially prohibiting factors of such a change can be attenuated through effective strategizing that involves the community members directly and indirectly impacted by the change.



“Adolescents who attend schools with later start times have been found to sleep more per night, resulting in a more positive temperament, fewer behavioural problems, and an increase in correlates of good academic performance such as attendance and continuous enrolment.”



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