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# ***Understanding today's learners: Cognitive impacts of technology use on adolescent learning***

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## **INTRODUCTION**

Adolescence is a period of rapid brain development and heightened sensitivity to environmental influences, making it important to understand how digital engagement shapes learning. This summary presents key findings from a comprehensive review of research on adolescents' technology use and its implications for cognitive processes and educational outcomes. For further details and references, refer to the full report.

## KEY FINDINGS

### 1 How adolescents use technology matters more than how much they use it

Findings suggest that how adolescents use technology may be more consequential than how much they use it. In particular, the quality of engagement appears to play an important role in shaping cognitive, academic, and well-being outcomes, not just screen time alone. Examples of quality engagement include, but are not limited to, technology that is used for educational purposes, well integrated into classroom practice, or used to support homework.

By contrast, use of technology becomes problematic when it is heavy or prolonged, when it is compulsive or exhibits addictive-like behaviors, and when youth are exposed to harmful online content. Such problematic use can interfere with an individual's well-being, functioning, and development. Indeed, across a broad body of research, including systematic reviews and high-quality studies, a relatively consistent pattern emerges: **problematic technology use is associated with reduced cognitive functioning**. The areas of cognitive functioning that are impacted include inhibitory control, working memory, cognitive flexibility, sustained attention, and self-regulation. These processes support goal-directed behavior, problem solving, and the ability to adapt effectively to new or complex situations.

### 2 Media multitasking negatively influences attention and comprehension

Media multitasking involves engaging with multiple media sources simultaneously, such as browsing an app while responding to messages and listening to music. It is a common feature of adolescents' daily routines and an important context in which cognitive processes are challenged and shaped.

- ✦ Evidence indicates that frequent media multitasking and problematic smartphone use are consistently associated with poorer attention and executive functioning in adolescents.
- ✦ Longitudinal research across large adolescent samples in Germany, China, Canada, and the United States indicates that early problematic or multitasking behaviours predict later attention difficulties, with stronger effects observed among younger adolescents and girls.
- ✦ While some studies find minimal effects on sustained attention itself, evidence suggests that multitasking during reading reliably predicts poorer text comprehension.

### 3 Patterns of technology use shape cognitive and academic outcomes

- ✦ The cognitive and academic effects of technology use vary by both purpose and engagement type. A large meta-analysis review that combined 183 studies across nine countries indicated that educational content may have neutral or protective effects, while entertainment-oriented or problematic use is more strongly linked to deficits in executive functioning.
- ✦ Importantly, problematic smartphone use is associated with lower academic achievement, with stronger effects among elementary and middle school students than older students, suggesting greater vulnerability in younger adolescents.

### 4 Problematic and late-night technology use is linked to poorer sleep, learning, and well-being

- ✦ Evidence from five review studies indicates that technology use, particularly at night, is consistently associated with reduced sleep duration, poorer sleep quality, longer sleep onset latency, and increased daytime sleepiness.
- ✦ These findings highlight that late-night technology use not only undermines sleep but also affects attention, executive functioning, academic outcomes, and overall well-being.
- ✦ There are small but reliable associations between technology use, especially social media engagement, and poorer adolescent well-being, with higher levels of engagement associated with increased risk.
- ✦ Several reviews report stronger associations for girls than boys, particularly for depressive symptoms and sleep-related outcomes, and there is some evidence that younger adolescents are also more vulnerable.

## CONCLUSIONS

Taken together, the evidence indicates that technology is neither inherently harmful nor a universal solution for adolescent learning; rather, its effects depend critically on how and why it is used. The challenge for educators and policymakers, therefore, is not to shield students from technology altogether, but to equip them with the cognitive and self-regulatory tools to engage with it productively. Thoughtful integration of digital awareness, attentional training, and structured learning design offers a practical path toward learning environments that reflect adolescents' digital realities while safeguarding their capacity for focus, deep learning, and well-being.

A copy of the full report is available at: [ibo.org/en/research](https://ibo.org/en/research).

For more information on this study or other IB research, please email [research@ibo.org](mailto:research@ibo.org).

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