

MEDIA USE, ATTENTION, MENTAL HEALTH AND ACADEMIC PERFORMANCE AMONG 8 TO 12 YEAR OLD CHILDREN

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- The rise in digital media consumption, especially among children, raises the societal question of its impact on cognition, mental health and academic achievement.
- Digital media consumption (e.g., watching videos, listening to music, playing video games) has increased drastically over the past decades

- In the US, 8–12 year old children spend an average of almost 6 hours on digital media every single day with a substantial fraction of that time spent on multiple media at the same time 29% for 7th to 12th graders.
- In the European Union, 10–14 years old spend an average of 2.8 hours a day on digital screens; for 15–19 years old that number increases to about 3 hours per day

- These numbers reflect the ubiquitous role that digital media has come to play in our lives, a role that is very likely to keep growing both in terms of the magnitude and the diversity of digital media consumption.
- This state of affairs raises increasing concerns about the impact of digital media consumption, in particular among children.
- The emerging literature on the impact of media use on cognition paints a rather complex picture whereby different media have distinct, and possibly opposite effects

- Children’s media consumption is frequently assessed through total time on media as if all forms of media represented a unitary experience
- To understand how digital media impacts children’s attentional and behavioral control, mental health and academic achievement requires a finer grained approach

Research increasingly suggests that the impact of digital media use on cognition, academic performance or health is complex as it depends on the :

- type of media (e.g., video games, social networks),
- content (e.g., fantasy, documentary),
- context (e.g., alone, in groups)
- the traits of the person consuming media [e.g., age, gender]

The present work builds on this recognized need for a finer grained approach:

- new experimental data which takes a more granular approach to media consumption by investigating three media consumption indices (total time on media, media multitasking and video game play)
- The present work addresses the relationships between these three distinct forms of media consumption and attentional and behavioral control (measured through both cognitive tests and questionnaires), mental health and sleep, grades, grit and mindset

This study focuses on three measures of media usage:

- total time on media,
- media multitasking
- video gaming

- The reviewed literature shows that different forms of media consumption may affect attentional/behavioral control, mental health and school related variables in different ways

- why exactly total time on media should correlate with attentional/behavioral control, mental health or school related variables
- Total time on media is a rough measure of media consumption and there are potentially many confounding variables (e.g., media multitasking habits) which might be responsible for the observed associations.
- Furthermore, total time on media might have only an indirect effect. For instance, total time on media may affect attention, mental health and school related variables via its negative effects on sleep

Media consumption by age and gender

- Total hours of media consumed per day increases with age (Spearman correlation $r = 0.35$, $p < 0.001$). At age 8, children consume on average 4 hours and 28 minutes of media per day; at age 12, that number increases to 8 hours and 14 minutes per day. For each additional year of age, total hours of media consumed increases by almost a full hour.
- The total amount of media consumed does not differ among boys and girls
- More specifically, boys spend more time on video games than girls
- Media multitasking also increases with age.. there is no difference in media multitasking scores between boys and girls
- boys spend more time on video games than girls do
- boys play more action-like video games than girls
- but there is no difference between them when considering time spent on other games

Attentional performance by age and gender

- *As children get older*

- response speed increases
- impulsivity decreases
- inattention decreases

- *The effect of gender was significant :*

- on impulsivity; with boys being more impulsive than girls
- on inattention with girls performing better
- but not on response speed

N=99

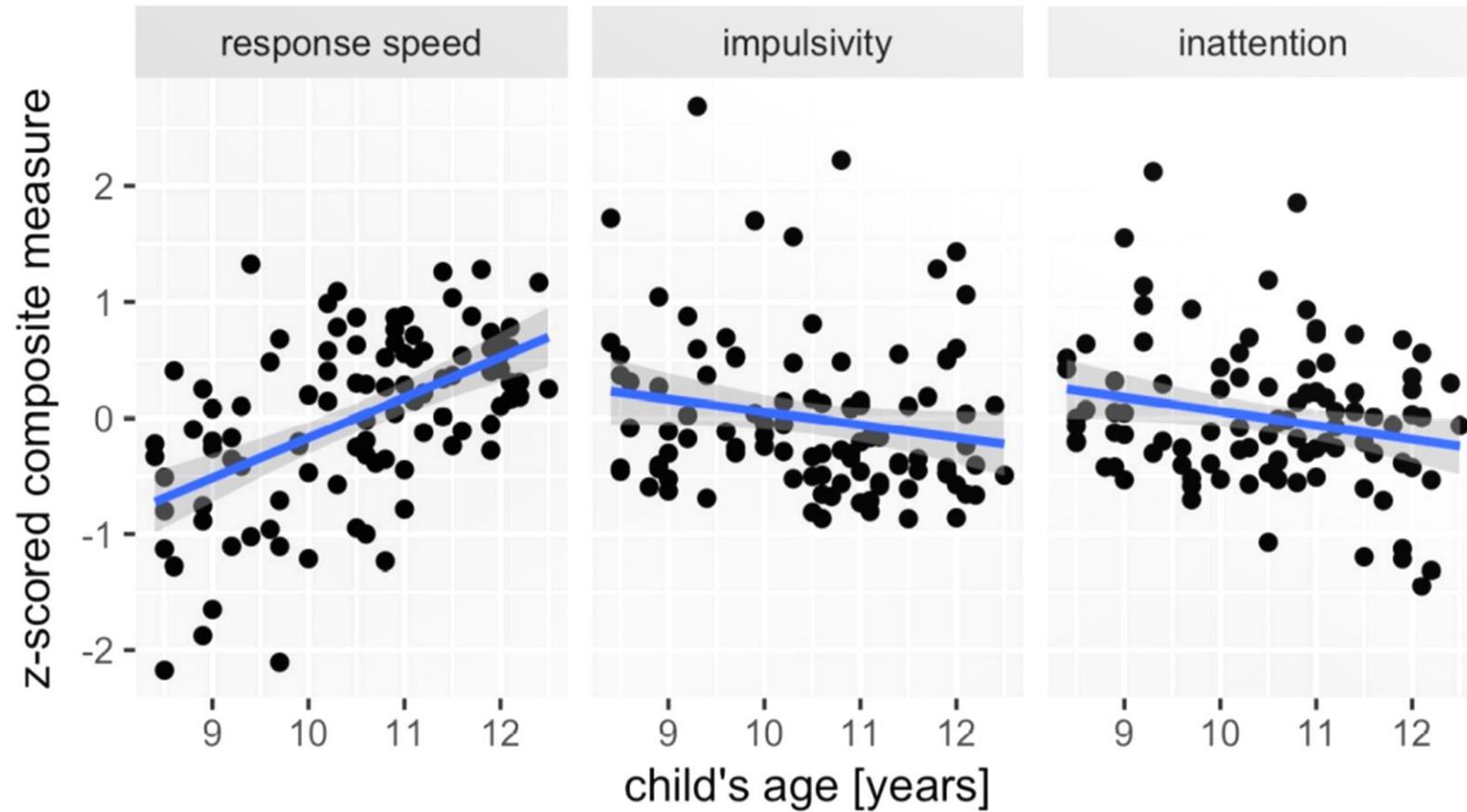


Fig 1. Cognitive performance as a function of children's age.

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Total media time and media multitasking

- **High levels of media multitasking are linked to:**
 - higher levels of distress
 - lower socioemotional functioning (SDQ),
 - more behavioral and attentional problems as measured by both Conner's Parents and Conner's Teachers,
 - as well as a reduced quality of sleep and lesser grit

Video game play

- Several meta-analyses document a positive impact of specifically action video games (AVG)—as compared to other types of video games—on cognition
- Playing AVG has been frequently related to improved attentional control and in particular improved top-down (but not bottom-up) attention
- AVG, defined in this literature as those in the first or third-person shooter genres, appear to have a greater positive impact on cognition than other types of video games.
- The positive relationship between action video game and cognition is unlikely to hold for video games at large.
- Indeed, the bulk of intervention studies using action video games makes it clear that not all video games have the same impact on cognition

Bottom-up and top-down attention

- Attention can be categorized into two distinct functions:
- ***bottom-up attention***: referring to attentional guidance purely by externally driven factors to stimuli that are salient because of their inherent properties relative to the background
- ***top-down attention***: referring to internal guidance of attention based on prior knowledge, willful plans, and current goals.

Top-down attention is dominant when:

- we feel irritable, but take deep breaths and calm ourselves
- we make a conscious choice to use our words rather than “hit”
- we set our sights on a goal and focus until we reach it
- meditate on our breath despite multiple distractions

- The relationship between video game play and mental health are somewhat mixed
- large amounts of gaming (more than 9 hours per week)—but not smaller amounts—were associated with increased conduct problems and reduced prosocial behavior
- . Similar conclusions seem to hold in older children [10-15 year-olds]; compared to children who do not play video games at all, children who play daily for more than 3 hours presented less prosocial behaviors, more conduct problems and decreased life-satisfaction.
- Children who played between 1 and 3 hours per day were equivalent in those measures as children who did not play at all.
- Surprisingly however, playing less than 1 hour per day was linked to the opposite pattern of results, suggesting that small amounts of video gaming might in fact have positive effects

- This hypothesis is corroborated by a European study on more than three thousand 6–11 year-olds which reported no sign of increased mental health problems as a function of video game play and instead, suggested that gaming might have a protective effect against difficult social relationships.
- The relationship between video gaming and academic performance remains, however, unclear : it can be positive, negative or absent depending on various factors (e.g., playing during weekdays versus weekend days ; playing before versus after school).

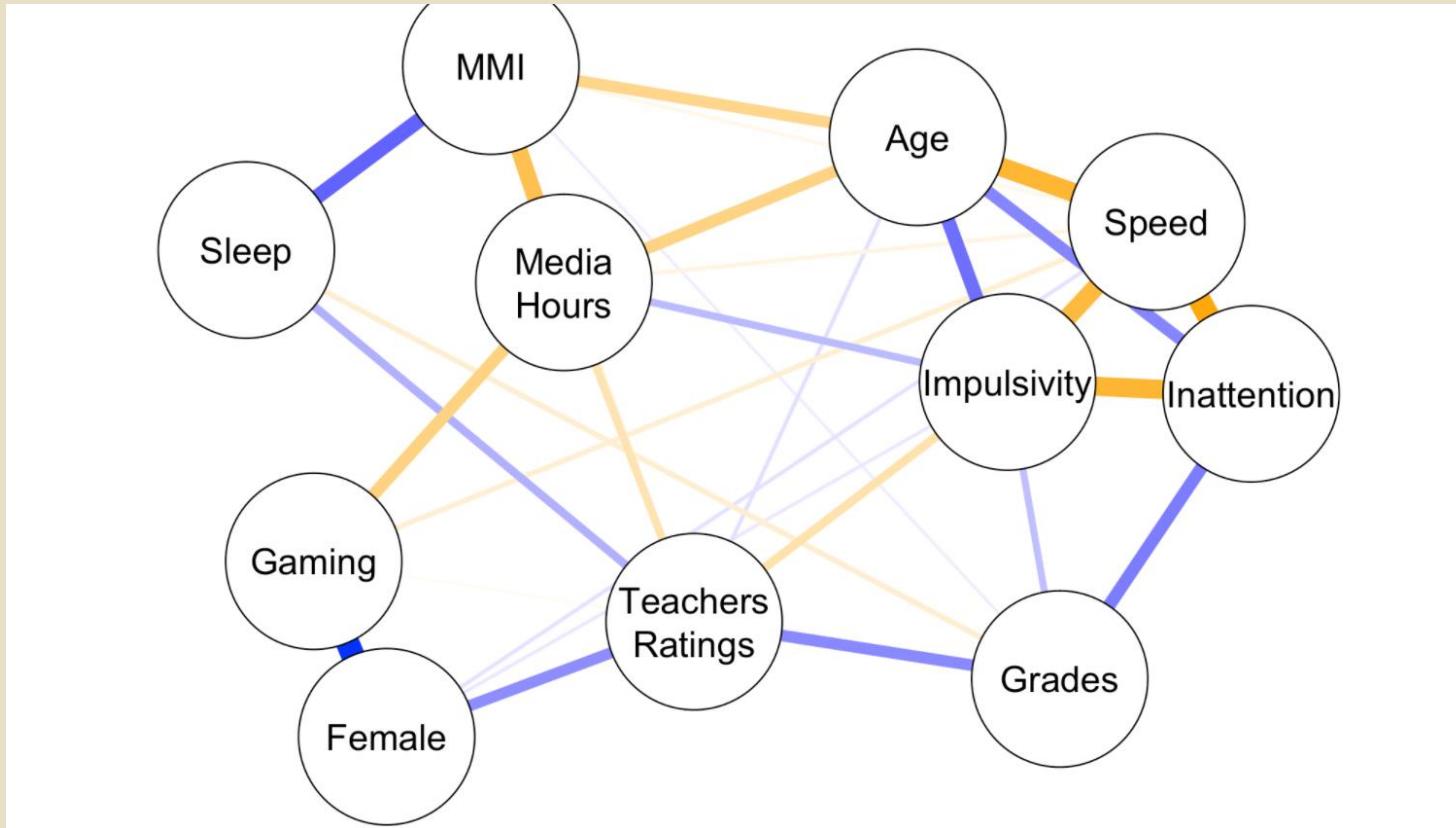
The relationship between gaming and academic outcomes might be U-shaped rather than monotonic, and might for instance depend on the type of games played.

- **Video gaming.**

- Overall, more time on video gaming is associated with faster response speed in the attentional control task without, however, any concomitant increase in error rates that could have been indicative of an increased impulsivity or inattention
- The response speed effect appears mostly driven by time on action-like games ($r = 0.22$, $p = 0.046$) rather than other types of games
- no clearly dissociable effects between action-like video games and other video games genres

media multitasking

- higher levels of MMI are associated with poor sleep and with more hours of media consumed; worse sleep and more hours of media consumed are associated with worse teacher rated attentional/behavioral problems, which in turn are associated with lower grades.
- Total hours of media is only indirectly related to grades via worse teacher ratings. Finally, there are no clear links between gaming and either grades, teacher ratings, or sleep.
- Gaming is only associated with increased response speed, albeit weakly



The width and saturation of the edges reflect the strength of the relationship; positive associations are highlighted in orange and negative associations in blue (e.g., higher levels of media multitasking (MMI) are associated with being older, higher number of hours of media and worse sleep quality).

- the amount of media content consumed each day increased steadily by one additional daily hour per year of age.
- From ages 8 to 12, the daily hours of media consumed increased from about 5 to 9 hours.
- girls and boys did not differ in terms of total media time or amount of media multitasking—
- Girls and boys did however differ in the types of media consumed, with boys reporting larger amounts of video game play, especially those containing action-like mechanics
- The extent to which these differences in media consumption foster gender differences in cognitive skills remains an interesting open question

Total media time and its limitations as a metric

- Total time on media is not a sufficient metric.
- . Total time on media correlates strongly with measures of more specific forms of media use, each of which having their unique, positive or negative impact

- total time on media appears determinant to account for poor attentional behavior.
- Children who spend more time on media are more frequently reported by their teachers to manifest ADHD-like behavior

- yet, partial correlation analyses reveal that media multitasking might be driving this effect.
 - We observe no significant relationships between total time on media and any of our outcome variables when controlling for media multitasking, age, and gender. Although these results could appear to contradict those published in the past.
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- these past studies used total media time without controlling for other types of media consumption.
 - In contrast to total media time, media multitasking is associated with more frequent ADHD-like behavior as rated by their teachers, when controlling for total media time, gender, and age.

Media multitasking versus video game play

- higher levels of media multitasking were associated with:
 - higher levels of psychological distress
 - lower levels of socioemotional functioning (SDQ),
 - worse behavior and attention ratings by both teachers and parents,
 - worse lower levels of grit.

- past research reporting an association between media multitasking and increased depression and anxiety among young adults after controlling for total time on media and various personality traits
- media multitasking and worse socioemotional outcomes and worse sleep among 8- to 12- year old girls
- negative link between media multitasking and worse sleep.
- children who report worse sleep both have worse grades and receive less favorable attention and behavior ratings from their teachers. A relationship between higher levels of media multitasking and worse sleep has already been reported several times, both in children and adolescents
- with some researchers suggesting that sleep is more strongly associated with media multitasking than with total time on media
- this is also the case here, as we observe no relationship between total time on media and sleep

- Contrary to the analysis on media multitasking, both partial correlation analyses on hours of video gaming (controlling for age, gender, total time of media consumed and media multitasking index) and the psychological network analyses revealed no significant adverse associations.
- More specifically, we observed no significant partial correlation involving video gaming and socioemotional functioning, attention and behavioral issues as rated by teachers and parents, sleep, mind-wandering, grit, growth mindset, grades and either impulsivity and inattention in cognitive tests

- Rather, we found positive relationships between time spent playing video games and both faster response speed in our attentional control tests, and reduced levels of psychological distress; indicating that playing video games might have a positive impact on specific measures of cognitive control and mental health
- The psychological network analysis (which included only a subset of the variables listed above) depicted a similar pattern of results, showing that more time spent on video games is associated with increased response speed in attention tests, in addition to being a male and spending more time on media overall

- When considering video game play in general, our results are partially in agreement with the literature which so far has yielded mixed results.
 - playing video games was linked with increased response speed without however affecting overall performance on the cognitive tests
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- In our study we found no direct relationship between time spent on video games and grades. Both the evidence and the opinions in the literature on how video gaming relates to academic performance are somewhat mixed.

- Some data on children and adolescents is compatible with video gaming being associated with greater school achievement , while other suggests either no relationship or a small/moderate negative relationship for those children who play video games before going to school
- . These mixed results are paralleled by different opinions on what relationship to expect
- On the one hand, researchers have argued that some kinds of video games improve cognitive abilities which are thought to be crucial for academic performance [105]; on the other, researchers expect video gaming to negatively impact academic performance by either taking away time from other activities, impairing sleep or the ability to concentrate in a slow paced school environment

- The present data do not support the view that video gaming impairs academic achievement as we find no direct relationship between video gaming and grades as well as no direct relationship between video gaming and sleep (we do however see the well-known link between better sleep quality and better grades).
- Gaming might affect educational performance by improving cognition, albeit indirectly, given the link between video gaming and cognition (increased speed) and the link between cognition and grades (lower impulsivity and inattention are linked to better grades)

- While our study does not resolve the many inconsistencies in the field of media and their impact on cognitive functioning, mental health, and school related variables, it clearly highlights a few major points.
- First, it is absolutely necessary to take into account not only total time on media, but also other, more specific measures of media consumption.
- Here we considered media multitasking and video game playing (in addition to total media time); it seems highly valuable for future studies to include social media, internet browsing or TV/video watching to cite a few
- From this point of view, media multitasking questionnaires could be further exploited to document these different forms of media consumption

- . Second, in the case of video games, the specific types of games that are played (e.g., action-like versus nonaction), how and when they are played (e.g., before or after school; in the morning versus evening) appear to be important factors to consider.
- As different video games have been shown to differently affect cognition, considering their impact separately may help explain some of the discrepancies in the literature

- . Third, while most empirical research focused on pairwise relationships (e.g., between playing video games and grades), researchers do in fact have implicit or explicit hypotheses of how specifically these variables relate (e.g., gaming improves educational attainment by improving attentional control

- media multitasking has been repeatedly associated with a greater tendency to mind-wander
- we also observed a correlation between mind-wandering and total hours of consumed media which itself correlates with media multitasking
- (for completeness, note that hours of video gaming does not correlate with mind-wandering)
- Such a pattern of results highlights the fact that it may be problematic to attribute the variations in mind-wandering to media multitasking rather than to total hours of consumed media.

Future perspectives

- Understanding how digital technologies impact our lives is extremely challenging because of the richness and ever changing landscape of digital media
- Indeed, there are many ways the same technology may be used, multitude of facets in our daily lives that technologies may impact (e.g., mental health, cognition, well-being to name a few) and numerous routes through which these variables may interact with each other.

Conclusion

- This study shows that different aspects of media consumption have different relationships with attentional/behavioral outcomes, mental health and school relevant variables, and thus highlights the importance of using more granular assessments than just total media time.
- It is not uncommon to read that time in front of screens should be limited
- The present paper indicates that such aggregate measures of media consumption are not sufficient and documents that the type of media used as well as how they are consumed both matter
- These analyses reveal that media multitasking more than video gaming and total time on media was associated with adverse psychological outcomes and that media multitasking should therefore be considered more intensively in future studies

Identifying effective intervention strategies to reduce children's screen time

- Meta-analyses show interventions targeting reductions in children’s screen time, either alone or as part of a multi-behavioral intervention, are effective in decreasing children’s screen time.
- Despite evidence on the effectiveness of interventions to reduce children’s screen time, it remains unclear what characteristics and behavior change techniques are the most critical to include in the design of screen time interventions.
- Behavior change techniques are the components or elements of an intervention, such as self-monitoring, social support, and signing behavioral contracts, that may serve as potential mechanisms underlying the effectiveness of behavioral interventions

Intervention characteristics

the most frequently included

- information on the behavior health link
- instruction
- social support

the least frequently included

- Behavioral contracts
- prompting cues
- motivational interviewing

- . Using the Hierarchical Behavior Change Technique Taxonomy ;
- 4 clusters of co-occurring behavior strategies were identified:
- 1) Goals, Feedback, and Planning,
- 2) Social Comparison,
- 3) Knowledge and Consequences
- 4) Behavioral Repetition and Practice

- the Goals, Feedback, and Planning cluster was associated with the largest impact on intervention effectiveness compared to those studies that did not include the Goals, Feedback, and Planning cluster.
- Interventions that included the Goals, Feedback, and Planning cluster were significantly associated with reductions in children's screen time.
- identified goal setting, positive reinforcement, and family social support as active ingredients in behavioral interventions targeting reductions in children's sedentary behavior

- of the Goals, Feedback, and Planning cluster was the driving behavioral strategy associated with enhanced intervention effectiveness:
 - behavior change techniques
 - identify alternative activities
 - combination of goal-setting and self-monitoring

- Goal setting may catalyze behavior change by serving as the “initial step” in the behavior change process.
- Goal setting may represent the starting point from which actionable steps can be taken to reach the destination of behavior change

- motivation is the link between goal setting and behavior.
- Without motivation, individuals will not set goals and make plans to modify their behavior

- strategies such as setting goals, providing graded tasks, or establishing a behavioral contract are often tailored to an individual's needs.
- Screen use, including the timing, the amount, and the type of device used is highly variable within an individual.
- Thus, the use of highly tailored behavioral strategies may lead to larger improvements in screen time at the individual level.

- Remember our children develop a healthy relations with gaming-it's to guide them in knowing themselves better, understanding their emotions, learning to make positive choices.
- Getting there won't happen quickly, but it's an attainable outcome

References:

- <https://doi.org/10.1371/journal.pone.0259163.g004>
- <https://doi.org/10.1371/journal.pone.0256591>
- <https://doi.org/10.1186/s12966-021-01189-6>

THANK YOU