# Digital Media Multitasking and its Relationship to Cognitive Representation Efficiency and Attentional Control in Adolescents with Low and High Digital Resilience

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**Abstract:** This research examined the relationship between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with high and low digital resilience. It also sought to identify significant differences based on gender (male - female), digital resilience level (low - high), and their interaction in digital media multitasking, cognitive representation efficiency, and attentional control. Participants included 120 adolescents (55 males, 65 females) recruited from selected preparatory and secondary schools in Kafrelsheikh City. Data were analyzed using appropriate scales and descriptive, correlational, and comparative methods through SPSS. Results revealed a negative relationship between digital media multitasking and both cognitive representation efficiency and attentional control. They also indicated statistically significant differences in digital media multitasking based on gender, favoring males, and based on digital resilience level, favoring those with low digital resilience. Additionally, there was an interaction effect between gender and group, favoring males in the low digital resilience group. On the other hand, the results showed statistically significant differences in cognitive representation efficiency and attentional control based on gender, favoring females, and based on digital resilience level, favoring those with high digital resilience. Moreover, an interaction effect was observed between gender and group, favoring females in the high digital resilience group. Based on these findings, recommendations for adolescent education and digital resilience development are discussed.

**Keywords:** Digital Media Multitasking; Cognitive Representation Efficiency; Attentional Control; Digital Resilience; Adolescents

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## INTRODUCTION AND THEORETICAL FRAMEWORK

Adolescence is a crucial developmental stage marked by rapid physical growth, psychological changes, and increased sensitivity to external stimuli. During this period, adolescents experience heightened emotional sensitivity, growing independence, and the development of abstract thinking and decision-making skills, which are essential for shaping their future. However, these changes also make adolescents more vulnerable to risky behaviors, including unhealthy digital habits. Support from family and schools is critical to guide adolescents through these challenges (Blakemore & Mills, 2014; Casey et al., 2008; Steinberg, 2014).

In recent years, digital media has become an integral part of adolescents' lives, influencing how they think, communicate, and engage with the world. In Egypt, for instance, the number of active social media users reached approximately 46.25 million in 2023, representing 41.4% of the total population, with 98.3% of youth engaging with platforms such as Facebook, TikTok, and Instagram (NAOS Solution, 2022). Similar high usage rates are seen across the Arab world, including Saudi Arabia (63.4%) and Iraq (68%) (Forbes ME, 2023). Globally, media multitasking is prevalent, with 40–70% of adolescents reporting regular engagement in such behaviors. For example, teens in the U.S. report multitasking frequently, while 16–24-year-olds in the UK consume media for up to 9.5 hours daily (Rideout et al., 2010; Ofcom & GfK, 2010; Riehm et al., 2019; Kong et al., 2023).

Digital media multitasking is an important aspect of media consumption habits; it is a prevalent behavior among adolescents who frequently engage in multi-media or non-media activities simultaneously. Studies show that digital multitasking leads to a more localized cognitive processing style and that the frequency of media switching predicts cognitive processing. Additionally, it influences conceptual processing style, leading to lower-level interpretation of behaviors in subsequent tasks. These findings suggest that media multitasking behavior may significantly alter viewers' processing of media content (Kazakova et al., 2015). This shift in academic tasks, which often involves switching between academic content and online media, significantly impacts their academic outcomes and performance (Le Roux et al., 2021). Riehm et al. (2019) reported that adolescents over 3 hours daily on social media are at higher risk for mental health issues. Digital media multitasking refers to a multifaceted concept that involves using multiple devices simultaneously, including multiple windows or applications, and using digital media such as texting while engaging in face-to-face communication (Tran et al., 2013).

Given their still-developing executive functions, adolescents are particularly susceptible to the cognitive costs of digital media multitasking, including reduced attentional control and lower cognitive processing efficiency. This is where digital resilience emerges as a key moderating factor. Digital resilience refers to adolescents' ability to navigate, adapt to, and recover from challenges in the digital environment, including exposure to harmful content, misinformation, and cyberbullying (Livingstone et al., 2017). Adolescents with higher digital resilience demonstrate stronger attentional control and cognitive representation efficiency, indicating that resilience may buffer the adverse effects of multitasking by enhancing self-regulation and adaptive coping mechanisms (Vissenberg & d'Haenens, 2020).

Digital resilience is an increasingly vital skill for adolescents to navigate the complexities of the digital age. It not only protects them from immediate risks such as cyberbullying and exposure to

inappropriate content but also builds long-term capacities including critical thinking, emotional regulation, and adaptive problem-solving in digital environments (Livingstone et al., 2017). By enhancing digital resilience, adolescents become better equipped to critically evaluate digital information, resist social pressure in virtual spaces, and maintain a balanced relationship with technology. This comprehensive competence supports healthy development and reduces their exposure to digital stress, making digital resilience a key focus for educators, parents, and policymakers.

Promoting digital resilience enhances adolescents' ability to manage digital stressors constructively and make safer, more informed decisions online. This impact extends beyond their emotional well-being to include their academic and cognitive development. Moreover, strengthening digital resilience can mitigate the long-term negative effects of digital overload, enabling adolescents to thrive in an increasingly connected world (Helsper & Eynon, 2013).

Digital multitasking reduces individuals' ability to filter out unnecessary information and negatively impacts the efficiency of information processing (Ophir et al., 2009). Cain et al. (2016) found that adolescents who engage excessively in media multitasking exhibit poorer concentration and attention, leading to a decline in the quality of their cognitive representation. Moreover, individuals who believe they can multitask effectively often perform worse cognitively due to their attention being divided across tasks (Sanbonmatsu et al., 2013). According to Schumacher et al. (2019), frequent digital multitaskers demonstrate poorer information integration and less organized mental representation, resulting in confusion and impaired information retrieval. These individuals also struggle to distinguish between priority tasks and essential details, which undermines both academic and cognitive performance.

Cognitive representation efficiency refers to the ability to retain and process information while performing one or more concurrent

cognitive tasks. For example, when someone remembers a title while listening to related instructions or numbers, they are utilizing working memory skills. This involves conducting memory processes in parallel with other mental activities (Wyer & Carlston, 2014). Additionally, cognitive representation encompasses the process of extracting, encoding, organizing, and integrating information from sensory experiences into memory (Sternberg, 1992). Al-Zayat (1996) defines cognitive representation as the internalization of meanings, ideas, and mental perceptions derived from symbolic and formal constructs, forming a part of an individual's long-term cognitive structure and enabling continuous interaction with the environment. Al-Zayat (2001) further emphasized seven key characteristics of cognitive representation efficiency: retention, meaning, derivation, synthesis, multiple forms of representation, cognitive flexibility, and dynamism. Retention involves the intentional memorization of information; meaning relates to establishing conceptual understanding; derivation reflects the acquisition of new knowledge; synthesis enables constructing new outcomes from various elements; multiple forms of representation facilitate self-organization; cognitive flexibility supports diverse processing methods; and dynamism reflects fluency in generating, synthesizing, and deriving information.

A study by Wiradhany and Koerts (2019) revealed that multitasking with digital media leads to "cognitive fragmentation", where mental processes become disjointed, impairing the ability to effectively represent and remember information. As a result, continuous exposure to digital media without sufficient attentional control directly contributes to the deterioration of cognitive functioning.

Attentional control is one of the most critical cognitive abilities influencing adolescents' development. It helps organize attention, manage distractions, and is essential for successful task completion in both daily life and academic settings. Adolescents with strong attentional control are better able to focus on academic tasks for extended periods, resulting in improved academic performance (Föcker et al., 2018). Attentional control forms the cornerstone of

cognitive learning by guiding, stimulating, and utilizing cognitive processes effectively (Amso & Scerif, 2015). It facilitates the flow of information, enhances comprehension, and improves recall by managing and linking stimuli (Harris et al., 2017). Furthermore, it increases working memory capacity by enabling the creation of multiple cognitive representations (Furley & Wood, 2016). Attentional control also supports information storage and enhances reading comprehension (Burgoyne et al., 2022). Students with strong attentional control consistently exhibit higher academic achievement (Rothbart & Posner, 2001). In the context of digital overload and multitasking, attentional control plays a crucial role in reducing the adverse effects of multimedia exposure (Ophir et al., 2009). It also helps adolescents regulate behaviors and emotions. Those with stronger attentional control are better able to manage impulses, reducing the risk of reckless or risky behaviors (Rothbart & Posner, 2001).

Attentional control refers to a complex set of cognitive processes that govern behavioral and executive functioning, essential for processing information. These include maintaining focus, shifting attention flexibly, and filtering out distractions (Cermakova et al., 2010; Eysenck et al., 2007). It involves upholding task performance rules in working memory, monitoring accuracy, and controlling both intentional and automatic distractions (Shi et al., 2019; Weidler, 2020). Additionally, attentional control acts as a cognitive adaptation strategy, allowing individuals to manage attention in response to both positive and negative stimuli. It comprises two dimensions: (1) Attentional focus, the ability to deliberately concentrate on relevant inputs while resisting distractions, and (2) Attentional shifting, the ability to purposefully redirect focus to desired stimuli while avoiding irrelevant inputs (Derryberry & Reed, 2002; Leleu et al., 2022).

The increasing prevalence of media multitasking among adolescents has raised concerns about its impact on attention. Baumgartner et al.

(2018) noted that frequent media multitasking is linked to attention-related problems. More recent research has investigated how such multitasking disrupts cognitive control mechanisms. Most studies report a modest negative correlation between media multitasking and cognitive control. For example, Ophir et al. (2009) found that heavy media multitaskers are more easily distracted by irrelevant stimuli compared to light multitaskers. Similarly, Baumgartner et al. (2014) found that adolescents who frequently engage in media multitasking report greater difficulties maintaining focus. Ralph et al. (2013) also noted a relationship between frequent media multitasking and self-reported attention issues.

There are three possible explanations for the link between media multitasking and attention problems. The first and most widely accepted is that media multitasking causes attention difficulties. The second hypothesis suggests that individuals with pre-existing attention issues are more likely to engage in media multitasking. The third proposes a reciprocal relationship, where each factor reinforces the other (Baumgartner et al., 2018).

In conclusion, the previous theoretical review highlights that the interaction between digital media multitasking, attentional control, cognitive representation efficiency, and digital resilience forms an integrated cognitive and behavioral system that profoundly influences adolescents' academic and psychological development. In light of the rapid expansion of digital media use, there is an urgent need to understand these variables scientifically, given their direct implications for educational performance and adolescents' ability to cope with increasing digital challenges. Research confirms that enhancing digital resilience and attentional control can mitigate the negative effects of digital multitasking and improve cognitive representation efficiency, thereby fostering adolescents' capacity for effective learning and sound decision-making in digital environments. Therefore, addressing these variables within an integrated theoretical framework represents a crucial step toward developing educational and counseling programs grounded in scientific principles that help prepare a generation that is more

aware, adaptive, and resilient in facing the demands of the digital age.

## Problem Statement

Digital media multitasking has become a significant challenge for adolescents. While the study conducted by Varela (2021) indicated no significant correlation between media multitasking and academic performance, several other studies suggest otherwise. For instance, Ophir et al. (2009) found that individuals who engage in digital multitasking struggle to filter out irrelevant information, leading to poor cognitive representation of important content. Similarly, the study by Wiradhany and Koerts (2019) showed that this type of multitasking increases cognitive load and reduces the quality of information processing, thereby impairing long-term information retention. Baumgartner et al. (2018) also reported a considerable correlation between media multitasking and attention issues in adolescents. In addition, Yildirim and Dark (2018) found that media multitasking is linked to increased mind-wandering and lower levels of mindfulness, suggesting that attentional control is compromised by frequent switching between media sources.

Cain et al. (2016) observed that adolescents who frequently engage in media multitasking exhibit higher rates of cognitive overload and attention deficits, leading to decreased academic performance. Supporting this, Loh and Kanai (2014) suggest that frequent media multitasking is associated with structural changes in the brain that can impair attention control and decision-making. Ophir et al. (2009) further demonstrated that high media multitaskers perform worse on tasks requiring cognitive control and sustained attention compared to low multitaskers. Likewise, Uncapher et al. (2016) reported that media multitasking impairs memory retention and reduces the ability to focus on tasks for extended periods.

Studies by Fried (2006) and Zhang (2015) also revealed that multitasking during class negatively impacts grades, note-taking, test performance, and self-regulation. Furthermore, May (2017)

emphasized the detrimental effects of media multitasking on students' cognitive and socio-emotional well-being, highlighting associations with high distractibility, decreased academic achievement, psychological distress, and increased social stress. Overall, Uncapher et al. (2017) noted that media multitasking disrupts concurrent learning and is associated with cognitive differences that may affect day-to-day thinking beyond the classroom due to its growing prevalence.

Based on the previously presented studies, digital media multitasking negatively affects attention, memory, and task performance, leading to reduced academic success and cognitive inefficiency. Despite the growing body of research on digital multitasking, there is still a need to explore how individual cognitive characteristics, such as attentional control and cognitive representation efficiency, may moderate or mediate these effects among adolescents, particularly within Arab or Egyptian contexts. Therefore, the research problem can be addressed through the following questions:

1. What is the nature of the relationships between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with low and high digital resilience?
2. Are there statistically significant differences attributed to gender (males-females) and group (low-high) digital resilience and their interaction on the digital media multitasking questionnaire?
3. Are there statistically significant differences attributed to gender (males-females) and group (low-high) digital resilience and their interaction on the cognitive representation efficiency questionnaire?
4. Are there statistically significant differences attributed to gender (males-females) and group (low-high) digital resilience and their interaction on the attentional control scale?

## Research Objectives

The current research aims to:

1. Identify the nature of the relationships between digital media multitasking and both cognitive representation efficiency and attentional control among adolescents with low and high digital resilience.
2. Detect differences attributed to gender (males-females) and group (low-high) digital resilience and their interaction on the scales of digital media multitasking, cognitive representation efficiency, and attentional control.

## Research Significance

This research derives its significance from the importance of the variables it addresses among adolescents, as follows:

1. Providing the Arab context with two highly reliable scales to measure digital media multitasking, cognitive representation efficiency, and a translated scale for attentional control.
2. Contributing to the scientific literature by establishing a theoretical framework for digital media multitasking, cognitive representation efficiency, and attentional control.
3. Offering new evidence to community institutions, particularly those focused on adolescent education, regarding the reasons behind digital media multitasking and excessive internet use among adolescents. This may help these institutions adapt their curricula and teaching methods to adopt new strategies for mitigating this phenomenon. Additionally, the research supports the development of training programs based on digital resilience to enhance cognitive representation efficiency and attentional control among adolescents, ultimately leading to improved educational outcomes.

## Hypothesis

After presenting the theoretical framework and previous studies, the research hypotheses can be formulated as follows:

1. There are no statistically significant correlations between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with low and high digital resilience.
2. There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the digital media multitasking questionnaire.
3. There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the cognitive representation efficiency questionnaire.
4. There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the attentional control scale.

## Method

### Participants

Participants included 120 adolescents (55 males and 65 females) recruited from selected preparatory and secondary schools in Kafrelsheikh City, Egypt. The study was conducted during the first semester of the 2024/2025 academic year. The sample was divided into two main groups based on their level of digital resilience: the low digital resilience group, comprising 50 adolescents (25 males and 25 females), and the high digital resilience group, comprising 70 adolescents (30 males and 40 females). The average age of the primary research sample was 16.24 years, with a standard deviation of 2.21. Additionally, a separate sample of 40 adolescents was used to assess the psychometric properties of the research instruments.

Participants were classified into the low and high digital resilience groups using a statistical criterion based on the mean and standard deviation of the digital resilience scores. The high digital resilience group included individuals whose scores were equal to or greater

than one standard deviation above the mean (Mean + 1 SD), while the low digital resilience group included those whose scores were equal to or less than one standard deviation below the mean (Mean – 1 SD). Participants whose scores fell between these thresholds were excluded from the comparative analyses to ensure a clear distinction between high and low levels of digital resilience.

## Materials

### Digital Resilience Scale (DRS)

The digital resilience scale is a self-report tool developed by Zayed (2024) to measure students' digital resilience. It consists of 16 items measuring awareness and recognizing online risks, being aware of solutions, gaining information and skills, managing stress, and progressing via self-efficacy. Statements 2, 6, 8, and 12 are formulated in reverse direction. The participant answers on a five-point scale. Point 1 indicates strong disagreement, and 5 indicates strong agreement. The total score for each participant ranges from 16 to 80. Higher scores indicate higher scores on the digital resilience scale. The author reported that the scale has high levels of validity, reliability, and internal consistency. In addition, the current author verified that the scale had a high degree of reliability, as the Cronbach's alpha coefficient was equal to .85 and the half-split correlation coefficient was equal to .89. Also, the correlation coefficients in internal consistency ranged from .79 to .88. The validity of the DRS was also verified, as it showed a distinction between high and low digital flexibility, and the t-value reached 10.31.

### Digital Media Multitasking Questionnaire (DMMQ)

Digital media multitasking questionnaire was developed by the current author and includes 12 statements. Participants using a four-point rating system reported adolescents' frequency of multitasking in various media formats, such as playing video games, watching TV, listening to music, talking on the phone, reading an electronic book, sending messages, playing games, doing assignments,

watching movies on the phone or computer, attending online lectures, using social networking apps, and other web activities. Participants responded on a four-point scale indicating how often they engaged in each of the activities on the scale, ranging from (1 = never), (2 = sometimes), (3 = often), and (4 = very often). The score of each participant ranges from 12 to 48. Higher MMQ values were associated with higher multitasking frequency. The DMMQ reliability was assessed using Cronbach's alpha equals 0.89, and convergent validity was also calculated as an indicator of the belonging of the items to the questionnaire, and the convergent validity coefficient was equal to .71. Also, internal consistency coefficients varied from .79 to .88.Thus, DMMQ reported reliability and validity evidence for assessing digital media multitasking in adolescents.

**Cognitive Representation Efficiency Questionnaire (CREQ)**

The cognitive representation questionnaire was developed by the current author to measure adolescents' cognitive representation efficiency, and it consists of 30 items formulated in the positive direction except items 3, 13, 19, 21, and 22, which were formulated in the negative direction. Participants answered the questionnaire on a five-point scale: always = 5, often = 4, sometimes = 3, rarely = 2, never = 1. Scores are reversed in the case of negative items. The participant's score ranges from 30 to 150, and the higher CREQ score means efficiency of cognitive representation.

The validity of the items of the cognitive representation efficiency questionnaire was calculated by calculating the correlation coefficient between the item score and the total score of the scale, considering the rest of the dimension items as a criterion for the item. All correlation coefficients were significant at 0.01, where the values of the correlation coefficients ranged between .73-.85. The validity of the one-way comparison was also calculated, where the value of "t" was 48.25. The reliability using the half-split method was calculated, and the values of the correlation coefficients ranged between .75-.85. The Cronbach's alpha coefficient for cognitive representation efficiency was calculated, and the stability coefficient

reached 0.75. Finally, the internal consistency was calculated, and the values of the correlation coefficient ranged between .79 and .89. From the above, it is clear that the questionnaire has a high level of validity and reliability.

**Attentional Control Scale (ACS)**

The attentional control scale was developed by Derryberry & Reed (2002) and was translated to Arabic by Mahmoud and Zayed (2024) to measure the general ability to control attention and consists of 20 self-report statements with a four-point scale (never = 1; sometimes = 2; often = 3; always = 4). Thus, the participant's score on the scale ranges from 20 to 80, half of which are formulated in the positive direction and the other half are formulated in the negative direction, measuring two related dimensions. The first is attention focus and includes (9) statements, for example: "I focus on what I am doing even when there is loud music." The second is attention shifting and includes (11) statements, for example: "I can read and write while talking on the phone." The scale has a high internal consistency coefficient and various validity evidence, such as convergent validity and predictive validity (Derryberry & Reed, 2002). Cronbach's alpha yielded a reliability coefficient of 0.85. Also, the scale indicates good internal consistency and ranged between.80 and 89. Additionally, the corrected item-total correlation coefficient for some statements was reported to be 0.88. These high correlation values suggest strong relationships between individual items and the overall scale, further supporting the internal consistency and reliability of the translated instrument.

**Research Procedures**

The procedural steps for this research were carried out as follows:

1. Randomly selecting a sample of adolescents from various middle and secondary schools.
2. Identifying the research sample based on digital resilience levels, selecting participants with high digital resilience who

scored above (mean + 1 standard deviation) on the digital resilience scale.

3. Ensuring the psychometric properties of the research tools by assessing internal consistency, validity, and reliability.
4. Administering the research tools at the beginning of the first semester of the 2024/2025 academic year.
5. Entering the data into the SPSS program, conducting statistical analyses, interpreting and discussing the results, and providing educational recommendations along with suggestions for future research.

**Statistical Analysis**

A set of statistical methods was employed to analyze the study data and test the research hypotheses**. Pearson Correlation Analysis** was conducted to examine the relationship between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with low and high digital resilience. Additionally, **Two-Way ANOVA** was used to test statistically significant differences in the research variables based on gender (male-female) and digital resilience level (low-high), as well as to assess the interaction effect between these variables on digital media multitasking, cognitive representation efficiency, and attentional control.

**Results**

*H 1.There are no statistically significant correlations between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with low and high digital resilience.*

To verify this hypothesis, Pearson's correlation coefficient was utilized, and the correlation coefficient between digital media multitasking and cognitive representation efficiency was (-.602), and (-.803) regarding the relationship between digital media multitasking and attentional control and corelation is significant at the 0.01 level.

The correlation coefficient values indicate that there is a negative relationship between digital media multitasking and both cognitive

representation efficiency and attentional control. Specifically, as the level of digital media multitasking increases, cognitive representation efficiency decreases, suggesting that individuals who engage in frequent media multitasking struggle with organizing and processing information effectively. Similarly, the negative relationship with attentional control suggests that increased multitasking with digital media is associated with a decline in the ability to focus and manage attention, leading to poorer control over cognitive tasks.

*H 2: There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the digital media multitasking questionnaire.*

To verify the validity of this hypothesis, the author used "two-way analysis of variance, and the results were as shown in Tables (1) and (2).

*Table 1. Means and standard deviations of adolescents' responses according to gender (male-female), digital resilience level (low-high), and their interaction on the digital media multitasking questionnaire.*

| Variables | Gender | Group | Mean | Std | No |
|---|---|---|---|---|---|
| Digital media multitasking | Males | Low digital resilience | 37.32 | 2.54 | 25 |
| | | High digital resilience | 33.60 | 3.04 | 30 |
| | | Total | 35.29 | 3.37 | 55 |
| | Females | Low digital resilience | 29.60 | 4.60 | 25 |
| | | High digital resilience | 24.55 | 3.05 | 40 |
| | | Total | 26.49 | 4.44 | 65 |
| | Total sample | Low digital resilience | 33.46 | 5.36 | 50 |
| | | High digital resilience | 28.42 | 5.43 | 70 |
| | | Total | 30.52 | 5.92 | 120 |

*Table 2. "F" Value and Its Statistical Significance Between The Average Scores of Adolescents According To Gender (Male-Female), Digital Resilience Level (Low-High), and Their Interaction on The Digital Media Multitasking Questionnaire.*

| Source of variance | Sum of squares | df | Mean squares | F value | Effect Size | Sig. |
|---|---|---|---|---|---|---|
| Gender | 2033 | 1 | 20.33.0 | 118.89 | .611 | 0.01 |
| Group | 555.997 | 1 | 555.997 | 49.744 | .362 | 0.01 |
| Gender* Group | 12.787 | 1 | 12.787 | 6.144 | .311 | 0.01 |
| Error | 1296.54 | 116 | | | | |
| Total | 115997 | 120 | | | | |

In light of the results presented in Tables 2 and 3, statistically significant differences were found in the mean scores of adolescents on the Digital Media Multitasking Questionnaire based on gender (male–female), level of digital resilience (low–high), and the interaction between them.

The results showed a significant difference between males and females in digital media multitasking, with an F value of 118.89 at a significance level of (Sig = 0.01) and a relatively high effect size ($\eta^2 = 0.611$), indicating that gender accounts for approximately 61% of the variance in digital media multitasking.

There was also a statistically significant difference according to the level of digital resilience, with an F value of 49.744, significance level (Sig = 0.01), and effect size ($\eta^2 = 0.362$), reflecting a notable impact of digital resilience level on multitasking behavior.

As for the interaction between gender and digital resilience, the results showed statistical significance with F = 6.144, Sig = 0.01, and a moderate effect size ($\eta^2 = 0.311$). This suggests that the effect of gender on digital media multitasking is influenced by the level of digital resilience, with males in the low digital resilience group being the most engaged in multitasking compared to other groups.

*H 3: There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the cognitive representation efficiency questionnaire.*

To verify the validity of this hypothesis, the author used "two-way .analysis of variance," and the results are presented in Tables 3 and 4

*Table 3: Means and Standard Deviations of Adolescents' Responses According to Gender (Male-Female), Digital Resilience Level (Low-High), and Their Interaction on The Cognitive Representation Efficiency Questionnaire.*

| Variables | Gender | Group | Mean | Std | No |
|---|---|---|---|---|---|
| Cognitive Representation Efficiency | Males | Low digital resilience | 67.88 | 9.67 | 25 |
| | | High digital resilience | 83.40 | 5.66 | 30 |
| | | Total | 76.34 | 10.93 | 55 |
| | Females | Low digital resilience | 79.84 | 8.97 | 25 |
| | | High digital resilience | 111.52 | 9.58 | 40 |
| | | Total | 99.33 | 18.09 | 65 |
| | Total sample | Low digital resilience | 73.86 | 11.03 | 50 |
| | | High digital resilience | 99.47 | 16.18 | 70 |
| | | Total | 88.80 | 19.04 | 120 |

*Table 4: F" Value and Its Statistical Significance Between the Average Scores of Adolescents According to Gender (Male-Female), Digital Resilience Level (Low-High), and Their Interaction on The cognitive Representation Efficiency Questionnaire.*

| Source of variance | Sum of squares | df | Mean squares | F value | Effect Size | Sig. |
|---|---|---|---|---|---|---|
| Gender | 11615.47 | 1 | 11615.47 | 155.06 | .572 | 0.01 |
| Group | 16108.28 | 1 | 16108.28 | 215.04 | .650 | 0.01 |
| Gender* Group | 1888.96 | 1 | 1888.96 | 25.90 | .479 | 0.01 |
| Error | 8689.17 | 116 | | | | |
| Total | 989422 | 120 | | | | |

The results presented in Tables 4 and 5 indicate statistically significant differences in adolescents' average scores on the Cognitive Representation Efficiency Questionnaire based on gender (male–female), digital resilience level (low–high), and the interaction between them.

The findings show a statistically significant difference between males and females in cognitive representation efficiency, with an F-value of 155.06 and a significance level of (Sig = 0.01). The effect size is $\eta^2 = 0.572$, indicating a large effect, meaning that gender accounts for approximately 57.2% of the variance in cognitive representation efficiency, in favor of females.

There was also a statistically significant difference based on digital resilience level, with an F-value of 215.04, (Sig = 0.01), and a large effect size of $\eta^2 = 0.650$. This suggests that digital resilience strongly influences differences in cognitive representation efficiency, in favor of those with high digital resilience.

Moreover, the interaction effect between gender and digital resilience was also statistically significant, with an F-value of 25.90, (Sig = 0.01), and a moderate to large effect size of $\eta^2 = 0.479$. This indicates that the influence of gender on cognitive representation efficiency varies depending on the level of digital resilience, with

females with high digital resilience showing the highest levels of efficiency compared to other groups.

*H 4:There are no statistically significant differences attributed to gender (male-female), digital resilience level (low-high), or their interaction on the attentional control scale.*

To test the validity of this hypothesis, the author employed a two-way analysis of variance (ANOVA), with the results presented in Tables 5 and 6.

*Table 5. Means and Standard Deviations of Adolescents' Responses According to Gender (Male-Female), Digital Resilience Level (Low-High), and Their Interaction on the Attentional Control Scale*

| Variables | Gender | Group | Mean | Std | No |
|---|---|---|---|---|---|
| Attentional Control | Males | Low digital resilience | 36.68 | 4.26 | 25 |
| | | High digital resilience | 54.46 | 3.32 | 30 |
| | | Total | 46.38 | 9.69 | 55 |
| | Females | Low digital resilience | 46.68 | 2.62 | 25 |
| | | High digital resilience | 65.70 | 3.88 | 40 |
| | | Total | 58.38 | 9.93 | 65 |
| | Total sample | Low digital resilience | 41.68 | 6.14 | 50 |
| | | High digital resilience | 60.88 | 6.67 | 70 |
| | | Total | 52.88 | 11.48 | 120 |

*Table 6. "F" Value and Its Statistical Significance Between The Average Scores of Adolescents According To Gender (Male-Female), Digital Resilience Level (Low-High), and Their Interaction on The Attentional Control Scale.*

| Source of variance | Sum of squares | df | Mean squares | F value | Effect Size | Sig. |
|---|---|---|---|---|---|---|
| Gender | 3259.18 | 1 | 3259.18 | 249.96 | .683 | 0.01 |
| Group | 9793.23 | 1 | 9793.23 | 75.96 | .866 | 0.01 |
| Gender* Group | 105.996 | 1 | 105.996 | 15.834 | .474 | 0.01 |
| Error | 1512.74 | 116 | | | | |
| Total | 351282 | 120 | | | | |

The results presented in Tables 5 and 6 indicate statistically significant differences in adolescents' average scores on the Attentional Control Scale based on gender (male–female), digital resilience level (low–high), as well as their interaction.

There were significant gender differences, with an F value of 249.96 at a significance level of 0.01, and a large effect size ($\eta^2 = 0.683$), suggesting that gender accounts for approximately 68.3% of the variance in attentional control scores, in favor of females. Additionally, significant differences were found based on the level of digital resilience, with an F value of 75.96 (Sig = 0.01) and a very large effect size ($\eta^2 = 0.866$), indicating that digital resilience strongly contributes to improved attentional control, favoring those with high digital resilience.

Moreover, a statistically significant interaction effect between gender and digital resilience was observed (F = 15.834, Sig = 0.01, $\eta^2 = 0.474$), suggesting that the effect of gender on attentional control varies depending on the level of digital resilience. Females with high digital resilience showed the highest scores on the attentional control scale compared to other groups.

## Discussion

Regarding the first hypothesis, which stated that there are no statistically significant correlations between digital media multitasking, cognitive representation efficiency, and attentional control among adolescents with low and high digital resilience, the results indicated a negative relationship between digital media multitasking and cognitive representation efficiency.

This finding is consistent with the study by Ophir et al. (2009), which suggested that individuals who frequently engage in media multitasking show reduced cognitive representation efficiency. This reduction manifests as impaired mental organization and concentration. Such individuals often perform poorly on tasks requiring cognitive control, such as maintaining focus on a single task and filtering out irrelevant information. Their difficulty in ignoring distractions and effectively switching between tasks leads to poor information processing.

Additionally, this result aligns with findings by Ralph et al. (2014), which linked media multitasking with impaired cognitive performance. Similarly, Cian et al. (2016) reported that adolescents who engage heavily in media multitasking tend to exhibit lower cognitive control, including shorter attention spans and weaker working memory.

On the other hand, Blacker and Curby (2013) suggested that continuous exposure to multiple streams of information might lead some individuals to develop a different cognitive style that allows greater task-switching flexibility. However, this flexibility comes at the expense of deep concentration and long-term information retention.

The negative relationship between digital media multitasking and cognitive representation efficiency may be attributed to several factors. Digital multitasking often disrupts cognitive processes such as focus, attention, and information retention. It can cause distraction, reduce the ability to prioritize important information,

and lead to cognitive overload. Moreover, interference between tasks may create confusion and disorganization, resulting in fragmented and poorly integrated knowledge.

In addition, the results revealed a negative relationship between digital media multitasking and attentional control. This finding supports the conclusions of Baumgartner et al. (2018), who reported a significant negative correlation between media multitasking and attention difficulties. Yildirim and Dark (2018) similarly found that multitaskers struggle to sustain attention due to constant switching between media sources, which undermines their ability to concentrate on a single task.

Consistent with these findings, Gazzaley and Rosen (2016) explained that processing multiple information sources simultaneously fatigues the brain, weakening attentional capacity over time even after multitasking has ceased. Ralph et al. (2014) also noted that individuals who frequently multitask tend to experience more frequent attention lapses, resulting in reduced sustained attention and increased mind wandering. Additionally, İmren and Tekman (2019) observed that while media multitasking may temporarily boost working memory, it significantly impairs attention retention.

This negative relationship can be further explained by the difficulty individuals face in maintaining focus amid constant digital distractions. Frequent switching between tasks increases mental load and decreases processing efficiency. Over time, this leads to cognitive fatigue and a reduction in long-term attentional capacity. Moreover, multitasking interferes with the brain's ability to suppress irrelevant stimuli, causing a decline in attentional control. As Mrazek et al. (2013) and Ralph et al. (2014) pointed out, such multitasking contributes to cognitive overload, diminished attention regulation, and more frequent episodes of mind wandering ultimately decreasing task performance and increasing error rates due to reduced awareness.

In conclusion, these findings provide sufficient evidence to reject the null hypothesis, which stated that there are no significant

relationships between digital media multitasking, cognitive representation efficiency, and attentional control. The data indicate that such relationships do exist and are notably negative in nature.

Regarding the second hypothesis, which stated that there are no statistically significant differences in adolescents' scores on the digital media multitasking questionnaire based on gender (male vs. female), digital resilience group (low vs. high), or their interaction, the results revealed statistically significant differences in digital media multitasking scores according to gender, with males scoring higher than females. Additionally, significant differences were found based on the level of digital resilience, as individuals with low digital resilience reported higher multitasking scores compared to those with high digital resilience. Moreover, the analysis indicated a significant interaction effect between gender and digital resilience level, with males in the low digital resilience group exhibiting the highest levels of digital media multitasking.

These findings can be explained by the observation that males tend to exhibit higher levels of digital media multitasking. This may be attributed to their greater interest in technology and more frequent engagement in media activities such as social media, video games, and online browsing, which expose them to more opportunities for multitasking (Broadbent, 2013).

This result is consistent with the findings of Lui et al. (2021), which indicated that boys tend to engage more in simultaneous multitasking, potentially due to individual differences in cognitive capacity. It also partially aligns with Ettinger and Cohen (2020), who found that boys were more likely to multitask with video games, while girls tended to combine texting, social networking, watching television, and listening to music. However, the current findings contrast with those of Foehr (2006), who reported that girls are generally more prone to media multitasking than boys.

Regarding differences based on digital resilience, the findings suggest that adolescents with low digital resilience may lack

effective strategies for regulating attention in media-rich environments. This makes them more susceptible to disorganized and frequent task-switching in digital contexts. Cain and Mitroff (2011) support this explanation, noting that individuals with low digital resilience tend to switch rapidly between digital tasks as a coping mechanism for distraction, resulting in increased but inefficient multitasking behavior.

The particularly high multitasking behavior observed among low digital resilience males may be explained by their greater tendency to engage in online leisure activities, such as gaming and social media, as a form of escapism or easy entertainment. According to Valkenburg and Peter (2011), individuals with lower digital resilience often resort to media multitasking to fill time or avoid challenges. Moreover, such individuals may seek immediate digital stimulation, for example, by frequently checking notifications or switching between apps, which fosters multitasking behavior. Ophir et al. (2009) also found that individuals with low digital adaptability tend to switch rapidly between digital tasks in response to the constant influx of information.

Based on the above results and discussion, the null hypothesis stating that there are no statistically significant differences attributed to gender (male vs. female), digital resilience group (low vs. high), or the interaction between them on the digital media multitasking questionnaire should be rejected.

Regarding the third hypothesis, the results revealed statistically significant differences in adolescents' scores on the cognitive representation efficiency questionnaire according to gender (male vs. female), favoring females. This finding contradicts the results of Suleiman (2023), who reported no gender differences in cognitive representation efficiency among adolescents. The superiority of females in cognitive representation efficiency can be explained by their stronger cognitive organization skills and greater ability to structure and connect information coherently, which enhances cognitive representation (Halpern, 2012). Furthermore, females tend to exhibit higher levels of cognitive control and are more adept at

managing and organizing information effectively. This cognitive control enhances their ability to filter out irrelevant information and retain what is important, contributing to stronger cognitive representations (Miller & Halpern, 2014).

There were also statistically significant differences based on digital resilience group (low vs. high), favoring the high digital resilience group. This result may be attributed to the fact that individuals with high digital resilience are better equipped to adapt to rapid technological changes and process new information efficiently, thereby enhancing their ability to form cognitive representations. This is supported by He and Freeman (2019), who found that individuals with higher digital resilience possess superior cognitive skills in analyzing and organizing digital information. Moreover, those with high digital resilience exhibit better control over cognitive functions such as attention, working memory, and task-switching, which are critical for effective cognitive representation. Blacker et al. (2013) also found that flexible technology users tend to have greater visual short-term memory capacity, a key component of cognitive representation. Additionally, individuals with high digital resilience are better at managing large volumes of digital information, filtering out distractions, and focusing on relevant content, leading to more structured and coherent cognitive representations (Valkenburg & Peter, 2011).

Furthermore, the results revealed a significant interaction effect between gender and digital resilience group on the cognitive representation efficiency questionnaire, with females in the high digital resilience group scoring the highest. This finding can be explained by the ability of these individuals to integrate and organize information from multiple sources in a cohesive manner. High digital resilience is associated with better visual memory organization and faster information processing (Blacker & Curby, 2013). Females with high digital resilience are also more likely to exhibit strong organizational skills, enabling them to handle and

structure large amounts of information effectively. According to Siddiqui and Singh (2016), girls with high digital resilience are especially capable of filtering out non-essential information and focusing on key content, thereby enhancing their cognitive representations.

Based on the above results and discussion, the author should reject the null hypothesis that there are no statistically significant differences attributed to gender (male vs. female), digital resilience group (low vs. high), or their interaction on the cognitive representation efficiency questionnaire.

Regarding the fourth hypothesis, the results revealed statistically significant differences in adolescents' scores on the Attentional Control Scale according to gender (male vs. female), favoring females. Additionally, statistically significant differences were found based on digital resilience group (low vs. high), with higher scores observed in the high digital resilience group. Furthermore, a significant interaction effect was found between gender and digital resilience group, with females in the high digital resilience group scoring the highest on attentional control.

The higher levels of attentional control observed in females with high digital resilience may be explained by their enhanced ability to adapt to the highly stimulating digital environment. High digital resilience enables individuals to effectively manage multiple sources of information and distractions, allowing them to filter out irrelevant stimuli and concentrate on essential tasks. This explanation is supported by He and Freeman (2019), who found that individuals with high digital resilience demonstrated improved attentional control and better management of digital distractions.

Moreover, females with high digital resilience may possess more advanced cognitive strategies for attentional regulation, such as selective focus and the use of digital tools to enhance task performance. These strategies help sustain attention over extended periods when interacting with digital content. Blacker and Curby (2013) also found that digitally resilient individuals exhibit a greater capacity to control complex visual stimuli.

High digital resilience further enables females to switch effectively between digital tasks without losing focus, indicating strong attentional regulation. This ability to manage task-switching without being overwhelmed by distractions contributes to improved attentional control. This finding is consistent with Valkenburg and Peter (2011), who showed that individuals with advanced digital skills are more capable of managing attention efficiently.

Additionally, digital resilience may reduce the cognitive load associated with navigating the digital environment, thereby enhancing attentional performance. Females with high digital resilience may also exhibit greater emotional regulation in the face of digital stressors, such as information overload or distraction-related anxiety. This emotional regulation supports stronger attentional control, aligning with findings by Miller and Halpern (2014), which showed that girls tend to have better control over cognitive-emotional responses than boys, positively influencing their attentional capabilities.

Based on these results and the discussion above, the author should reject the null hypothesis that there are no statistically significant differences attributed to gender (male vs. female), digital resilience group (low vs. high), or their interaction on the attentional control scale.

Finally, and in light of the findings revealed by the research, digital resilience is considered an essential skill for adolescents to help them adapt to the increasing challenges of the digital environment and protect their psychological and social well-being. To practically enhance this resilience, several strategies can be followed. First, digital education and awareness are fundamental steps, as training adolescents on self-regulation skills and time management in technology use helps reduce harmful behaviors such as digital addiction (Przybylski, 2014). Second, developing critical thinking skills toward digital content enables adolescents to evaluate information sources and protect themselves from fake news and

misinformation (Livingstone & Helsper, 2010). Third, providing psychological and social support enhances their ability to cope with psychological pressures resulting from cyberbullying or digital social stress (Smith et al., 2013). Additionally, research highlights the importance of enhancing awareness skills about privacy and personal data protection to maintain their digital safety (boyd, 2014). Finally, encouraging positive use of technology, such as participating in digital educational and creative activities, contributes to building self-confidence and the ability to face digital challenges constructively (Livingstone et al., 2017). By following these steps, adolescents can develop strong digital resilience that helps them benefit safely and effectively from the digital world.

## Conclusion

The current research explored the relationship between digital media multitasking, cognitive representation efficiency, and attentional control in adolescents with low and high digital resilience. The results showed a negative correlation between digital media multitasking and both cognitive representation efficiency and attentional control. Statistically significant differences in digital media multitasking were found based on gender, favoring males, and according to group, favoring those with low digital resilience. Additionally, an interaction effect between gender and group was observed, favoring males in the low digital resilience group.

Conversely, significant differences in both cognitive representation efficiency and attentional control were found based on gender, favoring females, and according to group, favoring those with high digital resilience. An interaction effect between gender and group was also noted, favoring females in the high digital resilience group.

The study offers important recommendations for adolescent education, highlighting the need to enhance digital resilience. It emphasizes the importance of reassessing a technology-driven lifestyle, as excessive digital media multitasking may impair attention and awareness and suggests strategies to better manage digital consumption.

## Recommendations

In light of the research findings, the following recommendations can be suggested:

1. Encourage the use of time and digital activity monitoring technologies, such as apps that help manage screen time and reduce digital distractions.
2. Provide specialized support for adolescents with low digital resilience through targeted training programs to improve their digital flexibility and reduce behaviors leading to digital multitasking.
3. Organize training programs to enhance digital resilience, focusing on attentional control techniques for male adolescents with low digital resilience, aiming to mitigate the impact of digital multitasking on their academic and cognitive performance.
4. Launch awareness campaigns targeting students and their families about the harms of digital multitasking on attention and awareness, offering practical advice for time management and reducing digital distractions.
5. Implement school policies that allocate specific times for digital device use during class hours to minimize interference and distractions caused by digital multitasking.
6. Integrate attentional control and self-regulation training into school curricula, especially for students who struggle with attentional control skills.
7. Schools should integrate smartphones into education, as they are more attractive to students and enable them to engage more effectively in the educational process instead of unsafe uses.
8. Schools should provide an educational environment that encourages critical thinking and analysis, helping students to engage with digital information consciously and reducing the impact of distractions caused by digital media.

9. There is a need to introduce training on psychological and social resilience that supports students' ability to cope with the digital and emotional challenges associated with internet use and social media.

## Future Research

1. The Impact of Digital Multitasking on Response Speed and Cognitive Processing Performance in Complex Tasks among Adolescents
2. Effectiveness of a Training Program Based on Digital Flexibility Skills in Enhancing Cognitive Abilities and Reducing Digital Multitasking among Individuals
3. Digital Multitasking and Digital Resilience as Predictors of Working Memory among Adolescents
4. Cognitive Representation Efficiency and Attentional Control among High School Students with Low and High Levels of Digital Multitasking
5. Digital media multitasking, cognitive representation efficiency, and attentional control in low- and high-achieving adolescents.

## Limitations

In light of the nature of the research and its procedures, several limitations should be considered when interpreting the results, including:

1. Sample Size and Composition: The sample was selected from a specific age group (adolescents) within a particular cultural and educational context, which may limit the generalizability of the findings to other age groups or settings.
2. Measurement Tools: The study relies on self-report questionnaires to assess digital media multitasking, cognitive representation efficiency, and attentional control, which may be subject to self-report biases.

3. Research Methodology: Since the study adopts a correlational approach, it identifies relationships between variables but does not establish causal links.
4. External Factors: Other variables, such as intelligence level and socioeconomic background, may influence the relationship between digital media multitasking, cognitive representation efficiency, and attentional control, but were not fully controlled in this study.
5. Technological Advancements: The rapid evolution of digital media usage may impact adolescent behaviors, suggesting that some findings may need reassessment over time.
6. Practical Applications: While the study provides practical recommendations, their implementation requires field testing to verify their effectiveness and actual impact on students.

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