Juggling with media

The consequences of media multitasking for adolescent development

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CHAPTER 1

The Consequences of Media Multitasking for Youth: A Review

ABSTRACT

The increasing prevalence of media multitasking among youth has raised concerns regarding its negative effects on youths' functioning. Although the number of empirical studies on the consequences of media multitasking for youth has grown rapidly, there has been no attempt to integrate theory with the results of these studies. This review integrates available findings on the relationship between media multitasking and three domains of youths' functioning: cognitive control, academic performance, and socioemotional functioning. Three databases (PsycINFO, ERIC, and CMMC) were searched to identify relevant studies, resulting in 8448 citations. Fifty-six studies met the inclusion criteria: nine studies on cognitive control, 43 on academic performance, and four on socioemotional functioning. Overall, the findings indicate a small to moderate negative relationship between media multitasking and the three domains of youths' functioning. However, evidence regarding the causal direction of this relationship is lacking. Based on the included studies, we identify several research gaps and present five main directions for future research: examining causality, establishing more targeted theories, improving media multitasking measurements, focusing on individual and contextual differences, and including representative samples.

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With the rise of mobile media technologies, the availability of media for youth has increased dramatically. The constant availability of media has led to an increase in media multitasking (e.g., Carrier, Cheever, Rosen, Benitez, & Chang, 2009; Rideout, Foehr, & Roberts, 2010). Media multitasking is typically defined as either simultaneously engaging in two or more types of media or using media while engaging in non-media activities, such as text messaging while studying (e.g., Jeong & Hwang, 2012; Wallis, 2010). The increase in media multitasking has raised concerns regarding its potential negative consequences for youth (Wallis, 2010). To date, research on media multitasking among youth has focused on three domains of youths' functioning: (1) youths' cognitive control abilities (e.g., the ability to sustain attention and efficiently switch between tasks); (2) their academic performance (e.g., perceived academic learning and course grades); and, more recently, (3) their socioemotional functioning (e.g., depression and social anxiety). Researchers often implicitly or explicitly state that media multitasking has negative effects on these three domains of youths' functioning.

The main assumption of the existing studies is that when youth frequently engage in media multitasking, they become accustomed to constant switching between activities and eventually lose their ability to focus on a single activity (Wallis, 2006, 2010). Media multitasking may therefore result in deficits in the control processes that regulate thoughts and actions (Ophir, Nass, & Wagner, 2009), also referred to as cognitive control abilities (Miller & Cohen, 2001). Deficits in cognitive control may in turn explain why media multitasking interferes with academic performance (e.g., Ophir et al., 2009) and socioemotional functioning (e.g., Becker, Alzahabi, & Hopwood, 2013).

Despite an increasing amount of studies on the relationship between media multitasking and the three domains of youths' functioning, our understanding of the potential effects of media multitasking on youths' functioning remains limited for two reasons. First, there is no consensus on the strength or direction of the effects of media multitasking on youths' functioning. Some studies have found a negative relationship between media multitasking and youths' functioning, but others have been unable to replicate these effects. These differences in findings across studies may result from the wide diversity in the conceptualization and measurement of outcome variables. Second, studies have rarely provided a clear theoretical background for the effects of media multitasking. The mixed findings and the lack of a theoretical framework make it difficult to interpret and integrate the findings. To advance the field, it is necessary to integrate the findings within the three domains based on existing theory.

Although a quantitative meta-analysis would be the optimal integrative method to take stock of this new strand of research, the available studies in each of the three domains are still too scarce and heterogeneous to justify a quantitative meta-analysis (Petticrew & Roberts, 2008). Therefore, we opted for a qualitative review which has three aims: (1)

to provide an overview of existing theories regarding the possible consequences of media multitasking within the three domains, (2) to integrate the existing findings to understand the potential influence of media multitasking on the three domains of youths' functioning, and (3) to identify the most important research gaps to provide guidelines for future research.

The focus of this review is on adolescents and emerging adults. Adolescence covers the age span between 12 and 18 years, and emerging adulthood is defined as the phase from the late teens through the late twenties (Arnett, 2000). Media multitasking is especially prevalent among these age groups (Carrier et al., 2009; Rideout et al., 2010; Voorveld & van der Groot, 2013). Moreover, these age groups may be particularly vulnerable to the effects of media multitasking because important aspects of cognitive, academic and socioemotional skills continue to develop during this period (Arnett, 2000; Crone & Dahl, 2012; Steinberg, 2005).

Media Multitasking Definition and Prevalence

At least two types of media multitasking can be distinguished: (1) using multiple media simultaneously and (2) using media while engaging in a non-media activity (Baumgartner, Weeda, van der Heijden, & Huizinga, 2014; Jeong & Hwang, 2012; Wallis, 2010). The first type of media multitasking involves the simultaneous use of two different types of media (e.g., the simultaneous use of TV and mobile phone) or engaging in multiple activities on a single device (e.g., using a laptop for watching movies and online shopping simultaneously; Yeykelis, Cummings, & Reeves, 2014). Recent research among 702 American adolescents between 12 and 18 years revealed that about 30% of their media use involves more than one medium concurrently (Rideout et al., 2010).

The second type of media multitasking involves the use of media while engaging in non-media activities, such as completing homework and engaging in face-to-face interactions. Particularly among adolescents and emerging adults, media are often used during academic activities (Wallis, 2010). On average, 31% of adolescents between eight and 18 years (N = 2002) reported using task-related and task-unrelated media "most of the time" while studying (Rideout et al., 2010). Moreover, approximately 62% of university students surveyed (N = 1026) reported using electronic media during academic activities (Jacobsen & Forste, 2011). This second form of media multitasking is particularly interesting because of its potential negative effect on academic performance (Wallis, 2010). The present review addresses the effects of both types of media multitasking among youth: (1) using multiple media simultaneously and (2) using media while engaging in a non-media activity.

METHOD

Search Strategies

We systematically searched for peer-reviewed quantitative empirical studies that were published prior to July 2014 using an electronic automated search strategy, developed by a librarian. Three databases were searched (PsycINFO, ERIC, and CMMC). The outcomes of this automated search were compared with a literature list of several media multitasking articles on the three domains that we retrieved through a manual search prior to the automated search. This literature list was used as a control group to verify the effectiveness of the automated search terms in locating relevant literature. First, variations of the word "media" (e.g., laptop/, social network/, and text messag/) were combined with variations of the word "multitasking" (e.g., multitask/, task analysis, and task complexity) for the automated search. This search strategy appeared satisfactory for media multitasking articles on cognitive control and socioemotional functioning, but not for articles on academic performance. Therefore, we added variations of the words "academic performance" (e.g., GPA, homework/, and reading comprehension) and "youth" (e.g., adolesc/, student/, and undergrad/) combined with the variations of the word "media" to the automated search strategy to find more studies on media use during academic activities. See Appendix A for a complete overview of the final search strategy. This automated database search was supplemented by examining the reference lists of the identified articles.

Inclusion Criteria

Studies were included in this review if they (1) examined the simultaneous use of multiple media, media use while engaging in a non-media activity, or both types of media multitasking; (2) investigated at least one of the three domains of youths' functioning (cognitive control, academic performance, and socioemotional functioning); (3) focused on adolescents and/or emerging adults; and (4) were published in a peer-reviewed English-language journal. We excluded studies that examined the specific effects of listening to music during academic activities. Research on background music is a specialized field often addressing the potential benefits of listening to specific types of music (e.g., relaxation or instrumental) during academic activities. Moreover, several reviews and meta-analyses already exist on the use of music during academic activities (e.g., Kämpfe, Sedlmeier, & Renkewitz, 2011; Črnčec, Wilson, & Prior, 2006).

Search Results

Our search resulted in 8448 citations (PsycINFO N = 3024, ERIC N = 4747, and CMMC N = 677). After removing duplicates, the first, second, and third author screened the titles of the remaining 7873 articles. The first author also screened a subsample of the articles (n = 1500) that were screened by the second and third author to double-check their selection. Thereafter, the first author determined from the remaining 662 abstracts whether the inclusion criteria were met. This procedure resulted in the identification of 147 potentially

relevant articles. These articles either clearly met the inclusion criteria after inspecting the abstract, or required an additional scanning of the full text to determine whether the articles met the inclusion criteria. This procedure resulted in a selection of 56 relevant articles that met the inclusion criteria: nine studies on cognitive control, 43 on academic performance, and four on socioemotional functioning.

MEDIA MULTITASKING AND COGNITIVE CONTROL

One of the main concerns regarding media multitasking is that it may result in deficits in cognitive control (Wallis, 2010). Cognitive control refers to the ability to select and maintain thoughts and actions that represent internal goals and means to achieve these goals (Miller & Cohen, 2001). Cognitive control is a complex top-down mechanism that includes several control processes, such as focusing attention on goal-relevant information, filtering irrelevant information, switching efficiently between tasks, and retaining temporary information (e.g., Miller & Cohen, 2001; Savine & Braver, 2010). These abilities are important components of youths' cognitive functioning, including their ability to concentrate. Youth with weak cognitive control abilities have reported difficulties staying focused (Kane et al., 2007).

Theoretical Background

Two contrasting hypotheses can be distinguished with regard to the effect of media multitasking on cognitive control. The first assumption is that media multitasking negatively affects cognitive control. More specifically, constant simultaneous exposure to several media activities may lead to "breadth-biased" cognitive control (Ophir et al., 2009). This term has been used to describe a cognitive processing style characterized by scattered attention toward several sources of information. Youth who frequently use several media simultaneously may become accustomed to processing information from several sources simultaneously. These youths may have more problems filtering irrelevant information from the environment as they attend to both relevant and irrelevant information (Ophir et al., 2009). By attending to all information to which they are exposed, these youths are more easily distracted from their main activity. According to this assumption, media multitasking may negatively affect cognitive control processes in the long term. We refer to this possibility as the "scattered attention hypothesis".

In contrast to the possible negative effects of media multitasking on cognitive control, some researchers argue that frequent media multitasking could also have a positive effect on cognitive control. Frequent media multitaskers may repeatedly practice coping efficiently with multiple streams of information (e.g., Alzahabi & Becker, 2013; Ophir et al., 2009). By constantly alternating between multiple media, youth may eventually train and improve certain control processes, such as task switching and filtering irrelevant information. In this paper, we refer to this assumption as the "trained attention hypothesis".

Studies Included

In total, nine correlational studies that examined the relationship between media multitasking frequency and control processes were included (see Table 1). Eight of these studies focused on emerging adults by including university students, and one study was conducted among adolescents (Baumgartner et al., 2014).

Table 1. Correlational Studies on Media Multitasking and Performance-Based Cognitive Control

Study	Age	*N* (HMMs/LMMs)	*Control process*	Correlation	HMMs vs. LMMs[a]
			Switching		
Ophir et al. (2009)	students	262 (19/20)	Number letter	n/a	-.31/-.39
Alzahabi & Becker (2013)	students	80 (20/20)/49 (13/13)	Number letter	.25/.30	.36/.45
Baumgartner et al. (2014)	11-15	523 (51/53)	Dots-Triangles	ns	ns
Minear et al. (2013)	18-25	221 (33/36)	Number letter	n/a	ns
			Filtering		
Ophir et al. (2009)	students	262 (19/20)	Filtering,/AX-CPT/ N-back	n/a	-.31 to -.34
Lui & Wong (2012)	19-28	63 (10/9)	Pip-and-pop	-.37	n/a
Baumgartner et al. (2014)	11-15	523 (51/53)	Eriksen Flankers	-.09/-.12ns[β]	ns
Minear et al. (2013)	18-25	53 (27/26)	Attention Network	n/a	ns
			Working memory		
Ophir et al. (2009)	students	262 (19/20)	AX-CPT	n/a	ns
Baumgartner et al. (2014)	11-15	523 (51/53)	Digit Span	ns/-.09ns[β]	ns
Minear et al. (2013)	18-25	53 (27/26)	Reading span// Recognition	n/a	ns
Sanbonmatsu et al. (2013)	18-44	277 (n/a)	Operation Span	-.19	-.25
			Sustained attention		
Cain & Mitroff (2013)	students	85 (21/21)	Additional singleton	n/a	-.37
Yap & Lim (2013)	students	66 (33/33)	Visual attention	n/a	-
			Response inhibition		
Ophir et al. (2009)	students	262 (19/20)	Stop-signal	n/a	ns

Note. Age = range or mean; HMMs = heavy media multitaskers; LMMs = low media multitaskers; n/a = not available; ns = not significant; - = media multitasking is negatively related to cognitive control; + = media multitasking is positively related to cognitive control; HMMs/LMMs = comparison between HMMs and LMMs (– indicating that HMMs performed worse, + indicating that HMMs performed better than LMMs); [β] = partial correlation; [a] = calculated Pearson product-moment correlation coefficient.

Measurements

All studies used the Media Multitasking Index (MMI, Ophir et al., 2009) or an adapted version of the MMI to examine media multitasking frequency. A higher score on the MMI indicates more frequent use of media multitasking. Based on the MMI scores, researchers typically compared two extreme media multitasking groups, heavy media multitaskers (HMMs) and light media multitaskers (LMMs), using different cut-off scores (e.g., based on quartiles, percentiles, or standard deviations).

Control processes were measured using standardized performance-based tasks or self-report questionnaires. Performance-based tasks are performed on a computer within a controlled laboratory setting (Ralph, Thomson, Cheyne, & Smilek, 2014). For example, Ophir et al. (2009) used the number-letter task to measure the ability to efficiently switch between identifying numbers (even or odd) and letters (vowel or consonant). For an overview of them performance-based tasks used in these studies, see Table 1. In contrast to performance-based tasks, self-report questionnaires measure control processes in everyday life (Baumgartner et al., 2014; Ralph et al., 2014). Seven studies used only performance-based tasks, one study used only self-reports (Ralph et al., 2014), and one study included both types of measures (Baumgartner et al., 2014).

Findings of Performance-Based Tasks

The eight studies that used performance-based tasks examined five control processes: (1) task switching (i.e., the ability to efficiently switch between multiple tasks, Monsell, 2003), (2) the filtering of irrelevant informant (i.e., the ability to ignore irrelevant information from the environment and internal representations in working memory, Ophir et al., 2009), (3) working memory capacity (i.e., the ability to temporarily store and retain information, Jeneson & Squire, 2012), (4) sustained attention (i.e., the ability to focus attention on the primary task, Cain & Mitroff, 2011), and (5) response inhibition (i.e., the ability to withhold a response if necessary, Verbruggen & Logan, 2008).

Task switching. Four studies examined the relationship between media multitasking and task switching (see Table 1). One study found that heavy media multitaskers (HMMs) were less able to efficiently switch between tasks than light media multitaskers, r = -.35 and -.43 (LMMs, Ophir et al., 2009). Although this result is consistent with the scattered attention hypothesis, three recent studies could not replicate these findings. Two studies found no significant correlation and/or difference between HMMs and LMMs (Baumgartner et al., 2014; Minear, Brasher, McCurdy, Lewis, & Younggren, 2013); one study indicated that, consistent with the trained attention hypothesis, media multitasking is related to more (rather than less) efficient task switching, r_{range} = .25 to .45 (Alzahabi & Becker, 2013).

Filtering of information. The second control process, the filtering of irrelevant information, was investigated in four studies (see Table 1). Consistent with the scattered attention

hypothesis, two studies showed that HMMs were less able to filter irrelevant information from the environment compared with LMMs, r_{range} = -.32 to -.52 (Lui & Wong, 2012; Ophir et al., 2009). In addition, Lui and Wong (2012) examined the performance of HMMs and LMMs in a multisensory integration task in which supposedly irrelevant information was presented (i.e., a signal) that in fact was relevant to fulfill the main task. Similar to the previous findings, HMMs were more sensitive to this relevant tone and therefore performed better than LMMs on the multisensory integration task. This finding shows that HMMs were more sensitive to supposedly irrelevant information, which may indicate that they have more difficulties filtering out information. Two studies, however, indicated that the correlation with and/or the difference between HMMs and LMMs was insignificant (Baumgartner et al., 2014; Minear et al., 2013).

Working memory capacity. Four studies examined the third control process, namely, working memory capacity (see Table 1). One study indicated that higher levels of media multitasking were related to lower performance on working memory tasks, *r* = -.19 and -.25 (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013), whereas three other studies indicated that the correlations and/or differences between HMMs and LMMs were not significant (Baumgartner et al., 2014; Minear et al., 2013; Ophir et al., 2009).

Sustained attention. Two studies examined the effects on sustained attention. Both studies found support for the scattered attention hypothesis (see Table 1). One study found that HMMs appear to be less able to selectively attend to a specific target compared with LMMs, *r* = -.36 (Cain & Mitroff, 2011). The other study showed that HMMs have a greater tendency to divide their attention than LMMs do (Yap & Lim, 2013).

Response inhibition. To date, only one study investigated the effects of media multitasking on response inhibition. This study indicated that the ability to inhibit a motor response, when examined in a stop-signal task, was similar for HMMs and LMMs (Ophir et al., 2009).

Findings of Self-Report Questionnaires

Two studies used self-report questionnaires to measure control processes in everyday life. Although these studies included different questionnaires, both studies showed that media multitasking was negatively related to a variety of control processes. Baumgartner et al. (2014) controlled for age, sex, and media use and showed that adolescents who frequently engaged in media multitasking reported more problems remaining focused (working memory), inhibiting inappropriate behavior (response inhibition), and switching between tasks (shifting) in their everyday lives (Baumgartner et al., 2014). Similarly, Ralph et al. (2014) found that media multitasking was positively related to self-reports of attentional failures and mind wandering. However, media multitasking was unrelated to attentional control (Ralph et al., 2014).

Conclusions on Media Multitasking and Cognitive Control

Despite common concerns regarding the negative effects of media multitasking on cognitive control (e.g., Wallis, 2010), the existing studies only partly support this concern. The empirical evidence for both the scattered attention and trained attention hypotheses is mixed. However, the findings are more consistent with the scattered attention hypothesis than the trained attention hypothesis. More specifically, higher levels of media multitasking were found to be negatively related to specific control processes (i.e., sustained attention) and cognitive control in everyday life when measured with self-report questionnaires. However, in contrast to expectations, media multitasking was unrelated to performance-based measures of working memory capacity, task switching, and response inhibition.

Overall, the two studies that used self-report questionnaires appear to be consistent with the scattered attention hypothesis. Both studies indicated that media multitasking is negatively related to cognitive control in everyday life. However, studies using performance-based tasks yielded evidence for either a null relationship or small to moderate negative relationship between media multitasking and cognitive control. The discrepancy between the results for these two types of measures may result from possible differences in the cognitive levels or skills that these measures assess (see Toplak, West, & Stanovich, 2013, for a discussion). Another reason may be the shared method variance between the self-report questionnaires of media multitasking and cognitive control (Baumgartner et al., 2014).

MEDIA MULTITASKING AND ACADEMIC PERFORMANCE

In most studies on the relationship between media multitasking and academic performance, academic performance refers to academic outcomes, such as grade point average (GPA), course grades, or test scores (e.g., Junco & Cotten, 2012; Wood et al., 2012). In addition to these academic outcomes, some studies have examined study-related attitudes and behaviors (e.g., study time, motivation, and the ability to focus on a study task) and perceived academic learning (i.e., students' perceived performance on academic tasks and their perceived understanding). In this review, we included studies on academic outcomes, study-related attitudes and behaviors, and perceived academic learning to examine whether media multitasking has negative consequences for youths' academic performance.

Theoretical Background

Researchers that have examined the relationship between media use during academic activities and academic performance hypothesize that media use during academic activities may lead to negative consequences for youths' academic performance. This hypothesis is based on two explanations. First, the time spent using media during academic activities may displace the time spent on academic activities (e.g., Fox, Rosen, & Crawford, 2009).

If students do not spend sufficient time on academic assignments, they may not perform to the best of their abilities. Second, several cognitive learning theories assume that using multiple streams of information decreases information processing as a result of people's limited cognitive capacity (Lang, 2000, 2006; Salvucci & Taatgen, 2008; Salvucci & Taatgen, 2010). Therefore, it has been argued that the use of media during academic activities limits the information processing capacity that is available for academic content (e.g., Junco & Cotten, 2011). Media use during academic activities thus hinders students' learning of academic content. Both the time displacement hypothesis and the limited information processing capacity hypothesis may explain why media use during academic activities interferes with academic performance.

In addition to the effects of media use during academic activities on academic performance, engaging in multiple media simultaneously may also be related to academic performance. Frequently using multiple media simultaneously may eventually result in deficits in cognitive control, as is argued by the scattered attention hypothesis (e.g., Ophir et al., 2009). These deficits in cognitive control may, for example, interfere with youths' ability to focus on an academic task (e.g., Ophir et al., 2009; Wallis, 2010). As a result, media multitasking may result in lower academic performance, mediated by deficits in cognitive control. To date, however, researchers have focused only on the effects of media use during academic activities. Therefore, we were able to examine only the relationship between media use during academic activities and academic performance.

Studies Included

In total, 43 studies examining media use during academic activities were included: 16 correlational studies (see Table 2), 25 experimental studies (see Table 3), and two descriptive studies (Braguglia, 2011; Johri, Teo, Lo, Dufour, & Schram, 2014). Thirty-seven of these studies focused on emerging adults by including university students, five studies focused on adolescents (Beentjes, Koolstra, & van der Voort, 1996; Pool, Koolstra, & van der Voort, 2003a, 2003b; Pool, van der Voort, Beentjes, & Koolstra, 2000), one study focused on pre-adolescents (Fetler, 1984), and one study focused on both adolescents and emerging adults (Rosen, Carrier, & Cheever, 2013).

Measurements

In all studies, media multitasking was measured by examining youths' media use during academic activities, either while studying or in class. Correlational studies used either questionnaires or observations to measure the frequency of media use during academic activities and largely focused on one media activity (e.g., text messaging and watching soap operas). To measure academic performance, correlational studies primarily used questionnaires. In the experimental studies, participants were exposed to media during an academic activity and subsequently their understanding of academic content and/or the time spent on the academic activity was measured.

Findings on Academic Outcomes

School grades. Eleven correlational studies examined whether media use during academic activities was associated with overall grades or test scores (see Table 2). Three studies had access to documented grades or GPA (Fetler, 1984; Junco, 2012; Junco & Cotten, 2012), whereas all other studies used self-reported grades or GPA. Three of 11 studies found no relationship (Clayson & Haley, 2013; Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 20121; Wei, Wang, & Klausner, 2012), whereas eight studies found small to moderate negative relationships between the use of media while studying or in class and students' grades or GPA, r_{range} = -.03 to -.30 (Burak, 2012; Duncan, Hoekstra, & Wilcox, 2012; Fetler, 1984; Gaudreau, Miranda, & Gareau, 2014; Junco, 2012; Junco & Cotten, 2012; Ravizza, Hambrick, & Fenn, 2014; Rosen et al., 2013). Three of these eight studies found that the effect of media multitasking on academic performance was dependent on which type of media was used during academic activities. In particular, using Facebook (Junco, 2012; Junco & Cotten, 2012; Rosen et al., 2013) and engaging in text messaging (Junco, 2012; Junco & Cotten, 2012) during academic activities were related to lower GPA. This result may be explained by the highly interruptive nature of these two specific media (Rosen et al., 2013).

Course and lecture outcomes. Fourteen studies examined whether media use during class was related to course and lecture outcomes: three correlational studies on final course grades (see Table 2) and 11 experimental studies on test scores relating to the content of the lecture(s) (see Table 3). All studies found that greater media use during class was related to lower course grades, r_{range} = -.16 to -.28 (Clayson & Haley, 2013; Fried, 2008; Grace-Martin & Gay, 2001) or lower test scores, r_{range} = -.21 to -.48 (Conard & Marsh, 2014; Ellis, Daniels, & Jauregui, 2010; End, Worthman, Mathews, & Wetterau, 2010; Hembrooke & Gay, 2003; Kraushaar & Novak, 2010; Kuznekoff & Titsworth, 2013; McDonald, 2013; Rosen, Lim, Carrier, & Cheever, 2011; Sana, Weston, & Cepeda, 2013; Wei, Wang, & Fass, 2014; Wood et al., 2012). One experimental study examined which specific type of media use during class had an influence on test scores. This study showed that it was not text messaging, e-mailing, or instant messaging but the use of Facebook during class that had a negative effect on students' test scores (Wood et al., 2012).

Homework outcomes. Fourteen experimental studies focused on homework outcomes. All of these experiments investigated reading assignments, and two of them additionally investigated math assignments. To study the effect of using media while reading, three types of reading outcomes can be distinguished: recognition, recall, and reading comprehension (see Table 3). Although one of three studies found that using media while reading negatively affected recognition, r = -.29 (Srivastava, 2013), two studies found no effect (Armstrong & Chung, 2000; Fox et al., 2009). In contrast, studies that investigated recall and reading comprehension rather than recognition presented clear evidence for the negative effects

of media use while reading. Five of six studies showed that students' recall deteriorated when simultaneously using media, r_{range} = -.23 to -.46 (Armstrong, Boiarsky, & Mares, 1991; Armstrong & Chung, 2000; Pool et al., 2003a, 2003b; Srivastava, 2013); only one study found no effect of media use while reading (Fox et al., 2009).

Table 2. Correlational Studies on Media Multitasking and Academic Performance

							SRAB	
Study	Age	*N*	MT	A	Grades /GPA[a]	Course grade[a]	Focus[a]	Perceived learning[a]
Junco & Cotton (2012)	17-56	1774	MP	S	-.09[β]/-.11[β]	n/a	n/a	n/a
Junco (2012)	17-56	1774	MP	C	-.09[β]	n/a	n/a	n/a
Fetler (1984)	6th grade	10603	TV	S	-.03[β]/-.08	n/a	n/a	n/a
Gaudreau et al. (2014)	16-50	1129	MP	C	-.28[β]	n/a	n/a	n/a
Rosen et al. (2013)	12-24	263	MP	S	-.23[β]	n/a	n/a	n/a
Ravizza et al. (2014)	students	508	MM	C	-.30	n/a	n/a	n/a
Burak (2012)	18-55	774	MP	C	-	n/a	n/a	n/a
Duncan et al. (2012)	n/a	316	CP	C	-	n/a	n/a	n/a
Karpinski et al. (2012)	students	451/406	SN	S	ns[eu]/-.28[us] ns[β]	n/a	n/a	n/a
Clayson & Haley (2012)	23	298	TM	C	ns	-.16	n/a	n/a
Wei et al. (2012)	18-49	190	TM	C	ns	n/a	-.26[β]/-.62[β]	ns
Grace-Martin & Gay (2001)	students	83	LT	C	n/a	-.28	n/a	n/a
Fried (2008)	students	137	LT	C	n/a	-.18[β]	-.32	-.17/-.19
Calderwood et al. (2014)	students	58	MP	S	n/a	n/a	-.34/-.38	n/a
Junco & Cotton (2011)	18-26+	4491	IM	S	n/a	n/a	n/a	-.37
Beentjes et al. (1996)	8-10th grade	1700	TV	S	n/a	n/a	n/a	-

Note. Age = range or mean; MT = media type (MP = multiple, TV = television, CP = cell-phone, SN = social network sites, FB = Facebook, TM = text messaging, LT= laptop, IM = instant messaging); A = activity (S = while studying, C = while in class); SRAB = study-related attitudes and behavior; n/a = not available; ns = not significant; - = media use during academic activities is negatively related to this component of academic performance; [β] = partial correlation; [a] = calculated Pearson product-moment; correlation coefficient; [eu] = Europe; [us] = United States.

Table 3. Experimental Studies on Media multitasking and Academic Performance

						Homework Outcomes				SRAB
Study	Age	*N*	MT	A	LO[a]	RG[a]	RC[a]	CP[a]	Math[a]	Time[a]
Wood et al. (2012)	20	145	MP	C	-	n/a	n/a	n/a	n/a	n/a
Ellis et al. (2010)	students	62	TM	C	-.48	n/a	n/a	n/a	n/a	n/a
Rosen et al. (2011)	18-66	185	TM	C	-.21	n/a	n/a	n/a	n/a	n/a
Hembrooke & Gay (2003)	students	44	LT	C	-.30	n/a	n/a	n/a	n/a	n/a
Sana et al (2013)	students	40	LT	C	-.43	n/a	n/a	n/a	n/a	n/a
Wei et al (2014)	19-22	127	OC	C	-.47	n/a	n/a	n/a	n/a	n/a
End et al. (2010)	20	71	CP	C	-.31/-.35	n/a	n/a	n/a	n/a	n/a
McDonald (2013)	students	119	TM	C	-.22[β]/-.41	n/a	n/a	n/a	n/a	n/a
Kraushaar & Novak (2010)	students	97	LT	C	-.36 to -.48	n/a	n/a	n/a	n/a	n/a
Conard & Marsh (2014)	21	110	TV	C	-.21[β] to -.31	n/a	n/a	n/a	n/a	n/a
Kuznekoff & Titsworth (2013)	18	47	TM	C	-.42 and -.43	n/a	n/a	n/a	n/a	n/a
Srivastava (2013)	students	295	PC	S	n/a	-.29	-.29/-.46	n/a	n/a	n/a
Armstrong & Chung (2000)	20	90	TV	S	n/a	ns	-.23	n/a	n/a	n/a
Fox et al. (2009)	students	69	IM	S	n/a	ns	ns	n/a	n/a	.44
Bowman et al. (2010)	17-46	89	IM	S	n/a	n/a	n/a	ns	n/a	.26
Armstrong et al. (1991)	students	95	TV	S	n/a	n/a	-.23[β]	n/a	n/a	n/a
Furnham et al. (1994)	18-30	60	TV	S	n/a	n/a	n/a	-.51	n/a	n/a
Armstrong & Greenberg (1990)	students	84	TV	S	n/a	n/a	n/a	-.36	n/a	n/a
Jeong and Hwang (2012)	23	88	TV	S	n/a	n/a	n/a	-.43/-.51	n/a	n/a
Lee et al. (2012)	students	30	TV	S	n/a	n/a	n/a	ns	n/a	n/a
Subrahmanyam et al (2013)	18-30	120	IN	S	n/a	n/a	n/a	ns	n/a	.41/.43
Pool et al. (2000)	14	144	TV	S	n/a	n/a	n/a	-.27	-.27	ns
Pool et al. (2003b)	14	192	TV	S	n/a	n/a	-.24/-.31	-.24/-.31	n/a	.38/.40
Pool et al. (2003a)	14	160	TV	S	n/a	n/a	-.36	-.36	n/a	ns
Cool et al. (1994)	nov-13	12	TV	S	n/a	n/a	n/a	ns	ns	ns

Note. Age = range or mean; MT = media type (MP = multiple, TV = television, CP = cell-phone, TM = text messaging, LT= laptop, OC= online chatting, PC = podcast, IM = instant messaging, IN = internet) ; A = activity (S = while studying, C = while in class); LO = lecture outcomes; SRAB = study-related attitudes and behavior (Time = study time, with + indicating that students in the multitasking condition needed more time to complete the task); RG = recognition; RC = recall, CP = reading comprehension; n/a = not available; ns = not significant; - = students in the multitasking condition performed significantly worse than students in de control condition; [β] = partial correlation; [a] = calculated Pearson product-moment correlation coefficient.

In addition, six of ten studies found that media use while reading interfered with reading comprehension, r_{range} = -.24 to -.51 (Armstrong & Greenberg, 1990; Furnham, Gunter, & Peterson, 1994; Jeong & Hwang, 2012; Pool et al., 2000, 2003a, 2003b). The other four studies found no effect (Bowman, Levine, Waite, & Gendron, 2010; Cool, Yarbrough, Patton, Runde, & Keith, 1994; Lee, Lin, & Robertson, 2012; Subrahmanyam et al., 2013).

In addition to examining reading outcomes, two experimental studies examined how math performance is affected by television use while working on a math assignment (see Table 3). One study found that watching television while working on a math assignment resulted in lower performance, r = -.27 (Pool et al., 2000), whereas the other study found that watching television while working on a math assignment had no effect on math performance (Cool et al., 1994).

Findings on Study-Related Attitudes and Behaviors

Fifteen studies examined study-related attitudes and behaviors: six correlational studies and nine experimental studies. These studies primarily examined two types of study-related attitudes and behaviors. Seven experimental studies investigated study time (see Table 3), and three correlation studies investigated the ability to focus on an academic activity (see Table 2).

First, four of the seven experimental studies on study time found that youth who used media while studying needed more time to complete an academic task, r_{range} = .26 to .44 (Bowman et al., 2010; Fox et al., 2009; Pool et al., 2003a; Subrahmanyam et al., 2013). The other three studies found no relationship (Cool et al., 1994; Pool et al., 2000, 2003b). Second, all three correlational studies on the ability to focus on an academic activity found that greater media use during academic activities was related to a perceived lower ability to focus, r_{range} = -.23 to -.38 (Calderwood, Ackerman, & Conklin, 2014; Fried, 2008; Wei et al., 2012).

Additionally, three correlational studies (Calderwood et al., 2014; Gaudreau et al., 2014; Junco & Cotten, 2011) and two experimental study (End et al., 2010; Kuznekoff & Titsworth, 2013) investigated other study-related attitudes and behaviors. These studies showed that media use during academic activities was related to perceived interference with finishing homework (Junco & Cotten, 2011), less academic satisfaction (Gaudreau et al., 2014), lower homework motivation (Calderwood et al., 2014), and interference with note-taking (End et al., 2010; Kuznekoff & Titsworth, 2013).

Findings on Perceived Academic Learning

Three correlational studies (see Table 2) and two descriptive studies (Braguglia, 2011; Johri et al., 2014) examined the relationship between media use during academic activities and youths' perceptions of interference with academic learning (Beentjes et al., 1996;

Fried, 2008; Wei et al., 2012). Two of three studies showed that media use during academic activities was related to lower perceived learning, namely, lower perceived performance on study assignments (Beentjes et al., 1996), and less perceived clarity and understanding of academic content (r = -.17 and -.19, Fried, 2008). One study, however, found no relationship between media use during academic activities and perceived learning (Wei et al., 2012). In addition, in two descriptive studies, youth frequently reported that their media use interfered with learning academic content (Braguglia, 2011; Johri et al., 2014).

Conclusions on Media Multitasking and Academic Performance

Studies of academic performance have solely addressed the specific effects of media use during academic activities. The majority of these studies indicated that media use during academic activities is negatively related to or interferes with three aspects of academic performance: (a) academic outcomes (i.e., GPA, grades, course/lecture outcomes, homework outcomes), (b) study-related behaviors and attitudes, and (c) perceived academic learning. However, the observed negative relationships or effects were often small to moderate and not always significant (see Tables 2 and 3).

MEDIA MULTITASKING AND SOCIOEMOTIONAL FUNCTIONING

Recently, concerns regarding the negative consequences of media multitasking on socioemotional functioning have been raised. Socioemotional functioning is a broad concept that is used to highlight the intertwining relationship between social and emotional functioning (Ochsner, 2008) and includes multiple components (e.g., Carter, Briggs-Gowan, Jones, & Little, 2003). To date, studies of media multitasking have focused on three possible components of socioemotional functioning: emotional functioning (e.g., depression and social anxiety), social functioning (e.g., sociability and social success), and regulatory behaviors (e.g., sleep).

Theoretical Background

Researchers have provided two potential explanations for why media multitasking may have a negative effect on socioemotional functioning. The first explanation is based on cognitive control as the underlying mechanism. It has been argued that deficits in cognitive control can explain the negative relationship between media multitasking on socioemotional functioning (e.g., Becker et al., 2013). The ability to control attention and cognitions – also known as effortful control in the psychological literature on socioemotional functioning – has often been linked to the ability to regulate emotions (Eisenberg, Hofer, & Vaughan, 2007). The ability to effectively regulate emotions is in turn related to a variety of positive social and emotional outcomes (Eisenberg et al., 2007). For example, more effective management of emotions may evoke more positive responses of others and may thus eventually enhance feelings of social competence (e.g., Eisenberg, Fabes, Guthrie, & Reiser,

2000; Eisenberg et al., 2007). If media multitasking causes cognitive control to deteriorate, then the ability to regulate emotions may be affected, leading to deficits in socioemotional functioning.

The second explanation focuses on the disruption and displacement of face-to-face interactions. Youth who engage in habitual media multitasking may actually use media during face-to-face communication, which could disrupt and displace face-to-face communication. As face-to-face interactions play a crucial role in youths' healthy socioemotional development (Pea et al., 2012), limited face-to-face interactions may have a negative influence on socioemotional functioning.

Studies Included

In total, four correlational studies that have examined the relationship between media multitasking and socioemotional functioning among youth were included (see Table 4). Two studies included university students (Becker et al., 2013; Shih, 2013), one study included adolescents (12-18 years old, Calamaro, Mason, & Ratcliffe, 2009), and one study included pre- and early adolescents (8-12 years old, Pea et al., 2012).

Measurements

All studies used the MMI (Ophir et al., 2009) or an adapted version. In addition, one study included an instrument called the Survey of the Previous Day, which examines youths' media multitasking behaviors of the previous day (Shih, 2013). To measure socioemotional functioning, several subdomains of socioemotional functioning have been assessed using questionnaires (for an overview of these subdomains, see Table 4).

Findings on Socioemotional Functioning

The four studies examined different components of socioemotional functioning: three studies on emotional functioning, two on social functioning, and two on regulatory behaviors (i.e., sleep) (see Table 4). Although one study found that media multitasking was unrelated to positive aspects of emotional functioning (i.e., emotional positivity and well-being, Shih, 2013), the other two studies showed that media multitasking was related to problematic emotional functioning, r_{range} = .05 to .19. In particular, more media multitasking was related to more symptoms of depression, higher levels of social anxiety (Becker et al., 2013), and fewer feelings of normalcy (Pea et al., 2012). Moreover, the two studies on sleep showed that more media multitasking was related to less sleep, r = -.09 (Calamaro et al., 2009; Pea et al., 2012), more difficulties in falling asleep on a weeknight, and a higher likelihood of falling asleep during school (Calamaro et al., 2009). By contrast, both studies on social functioning found no relationship between media multitasking and social functioning (Pea et al., 2012; Shih, 2013).

Table 4. Correlational Studies on Media Multitasking and Socioemotional Functioning

Study	Age	*N*	Socioemotional Functioning	Correlation
			Emotional functioning	
Becker et al. (2013)	students	318	Depression	.19$^{\beta}$
			Social anxiety	.17$^{\beta}$
Pea et al. (2012)	8-12	3461 girls	Feelings of normalcy	-.05$^{\beta}$
Shih (2013)	18-43	138	Emotional positivity	ns
			Emotional well-being	ns
			Social functioning	ns
Pea et al. (2012)	8-12	3461 girls	Social success	ns
Shih (2013)	18-43	138	Sociability	ns
			Regulatory behaviors	
Pea et al. (2012)	8-12	3461 girls	Hours of sleep	-.09$^{\beta}$
Calamaro et al. (2009)	12-18	100	Hours of sleep on school nights	-
			Falling asleep during school	-
			Difficulties falling asleep on a weeknight	-

Note. Age = range or mean; 0 = not significant, - = media multitasking is negatively related to this aspect of socioemotional functioning; + = media multitasking is positively related to this aspect of socioemotional functioning; $^{\beta}$ = partial correlation.

Conclusions on Media Multitasking and Socioemotional Functioning

The few available studies on socioemotional functioning indicate that media multitasking is related to lower emotional functioning, less sleep and more sleeping problems. In contrast, media multitasking appears to be unrelated to social functioning.

DISCUSSION

Despite an increasing number of empirical studies on the consequences of media multitasking for youth, there is still little clarity regarding the potential negative effects of media multitasking on the three domains of youths' functioning: cognitive control, academic performance, and socioemotional functioning. The aim of the present review was therefore to summarize existing theories and integrate available findings.

Overall, the studies on cognitive control show that media multitasking is negatively related to cognitive control in everyday life as measured with self-reports of cognitive control. Moreover, media multitasking is negatively related to specific cognitive control processes as measured with performance-based tasks, in particular to the ability to sustain attention. These findings are in line with the scattered attention hypothesis, which states that

youth who frequently engage in media multitasking may lose the ability to focus on one activity. It must be noted, however, that media multitasking is unrelated to some cognitive control processes, measured with performance-based tasks. For example, the majority of the studies found no evidence for a relationship between media multitasking and task switching or working memory capacity (e.g., Baumgartner et al., 2014; Minear et al., 2013).

With regard to academic performance, the majority of the studies show that media use during academic activities is negatively related to the three aspects of academic performance (i.e., academic outcomes, study-related attitudes and behaviors, and perceived academic learning). These negative relationships were found in experimental as well as survey studies, although the effects in both types of studies are small to moderate. Two potential explanations for these effects have been put forward: (1) media multitasking may displace the time spent on academic activities (e.g., Fox et al., 2009), and (2) media use during academic activities may limit the information processing capacity that is available for the academic content (e.g., Junco & Cotten, 2011). However, because none of the studies has investigated the underlying mechanisms of this relationship, it is as yet not possible to single out which explanation is most valid.

Lastly, the few studies on socioemotional functioning show that media multitasking is negatively related to several subdomains of socioemotional functioning. Youth who reported higher levels of media multitasking showed lower emotional well-being and more sleep problems. Although the theoretical link remains somewhat vague and possible underlying mechanisms have not been examined yet, media multitasking could interfere with socioemotional functioning through (1) deficits in cognitive control, and (2) disruption and displacement of face-to-face interactions.

Overall, the available studies indicate a small to moderate negative relationship between media multitasking and cognitive control, academic performance, and socioemotional functioning. Although the findings of previous research have been important in highlighting current concerns regarding media multitasking among youth, this review identifies important research gaps. To further advance this research field, we have thus identified five areas that need more attention in future research on media multitasking among youth: examining causality, establishing more targeted theories, improving media multitasking measurements, examining individual differences, and including representative samples.

Research Gaps and Directions for Future Research

Examining causality. Most importantly, the direction of the relationship between media multitasking and the three domains of youths' functioning remains unclear. To date, researchers have primarily relied on cross-sectional data. Therefore, findings regarding the direction of the relationship between media multitasking and the three domains of youths'

functioning are inconclusive. Although it is typically argued that media multitasking leads to problems in cognitive control, academic performance, and socioemotional functioning, the relationship could also be reversed or reciprocal, as is consistent with many contemporary media-effects theories (Valkenburg & Peter, 2013). For example, it is possible that youth who show deficits in cognitive control, academic performance, and socioemotional functioning are more likely to engage in media multitasking. Youth who show deficits in cognitive control may have difficulties in their ability to sustain attention on one media activity and may therefore simultaneously engage in other media or non-media activities. Similarly, it could be that students with lower academic performance are less motivated at school (Richardson, Abraham, & Bond, 2012), which may lead to an increased use of media during school-related activities. Less motivated students may also be less willing to regulate their media use while learning (e.g., Schunk & Zimmerman, 2008). Therefore, to advance the field and address the question of causality, longitudinal studies of media multitasking and youths' functioning are needed.

Establishing more targeted theories. Few studies on media multitasking among youth have been conducted using a clear theoretical framework. A clear theoretical framework can provide guidelines regarding the variables that should be investigated and can enhance the cohesiveness of research on media multitasking among youth. Many studies have not included an explicit hypothesis regarding the mechanisms that explain the relationship between media multitasking and youths' functioning. To establish these theories, future research should formulate and test specific hypotheses and examine potential underlying mechanisms to explain why media multitasking interferes with cognitive control, academic performance, and socioemotional functioning.

For example, a clear theoretical framework for the underlying mechanisms in the relationship between media multitasking and academic performance is missing. Two potential mechanisms that could explain this relationship could be (1) the displacement of time spent on an academic task (e.g., Fox et al., 2009), or (2) limited information processing capacities for academic content when using media simultaneously (e.g., Junco & Cotten, 2011), or both. The displacement hypothesis might also play an important role for explaining the negative relationship between media multitasking and socioemotional functioning. More specifically, media multitasking could simply displace the time spent on face-to-face interactions (Pea et al., 2012). This displacement of face-to-face interactions may lead to lower socioemotional functioning.

In addition, cognitive control may play a crucial role in the explanation of media multitasking effects, not only as a direct effect but also as a mediator of the effects between media multitasking and academic performance and socioemotional functioning. If media multitasking results in deficits in cognitive control, these deficits may lead to lower academic performance and lower socioemotional functioning. For example, adolescents

who have difficulties sustaining their attention may have difficulties to perform well in school. Similarly, it has been argued that deficits in cognitive control may result in lower socioemotional functioning, because the ability to control attention and cognitions has been linked to the ability to regulate emotions and expressions (Eisenberg et al., 2007).

Another aspect that needs to be taken into account in future studies is that media multitasking includes at least two types of multitasking with media: the simultaneous use of more than one medium and media use while engaging in non-media activities (Jeong & Hwang, 2012; Wallis, 2010). Studies vary greatly in the type of media multitasking that they include. Whereas some studies focus explicitly on the simultaneous use of more than one medium (e.g., Ophir et al., 2009), others also examine media use while engaging in non-media activities (e.g., Shih, 2013). To improve the comparability across studies and to examine the consequences of each type of media multitasking, both types should be examined.

Moreover, studies of academic performance have solely addressed the effects of media use during academic activities on academic performance. This type of media multitasking may have a direct effect on academic performance because it may directly interfere with academic activity. However, media multitasking could in the long-term also have an indirect effect on academic performance through its effect on cognitive control (e.g., Ophir et al., 2009). If adolescents lose their ability to focus and sustain attention, this may have negative consequences for their academic performance in the long run. Therefore, future studies on academic performance should examine not only the direct effect of media use during academic activities but also the long-term effects of media multitasking.

Finally, conceptualizations of the consequences of media multitasking vary considerably, which makes it difficult to compare findings across studies. More specifically, the included studies examined (1) various control processes and different performance-based tasks for the same control process, (2) multiple measures of academic performance, and (3) highly diverse subdomains of socioemotional functioning. Future studies should emphasize which subdomains are included, why these domains are chosen, and how they are measured.

Improving media multitasking measurements. Tools for measuring media multitasking are sometimes questionable. Although all studies on the relationship between media multitasking and cognitive control have used the MMI to measure the simultaneous use of multiple media, researchers have used several different cut-off scores to differentiate heavy media multitaskers from light media multitaskers (Minear et al., 2013). The majority of the studies use the upper and lower quartiles to select heavy media multitaskers and light media multitaskers respectively. Therefore, we suggest that future studies should use the upper and lower quartiles as a fixed cut-off mark to facilitate comparisons across studies. Moreover, only a few researchers have examined the continuum of media

multitasking. Solely investigating extreme groups and using different cut-offs weakens the comparability among studies. Therefore, future research should address the continuum of media multitasking and should not solely use cut-offs to categorize multitaskers.

Finally, research on the relationship between media multitasking and academic performance often includes only one type of media use (e.g., Facebook, text messaging, or TV). It is important to realize that this focus on a single medium does not accurately capture the current media-saturated environment of youth (e.g., Lee et al., 2012), who may actually be Facebooking, texting, and watching TV while they are working on their homework.

Focusing on individual and contextual differences. Some initial attempts have been made to examine individual differences in the relationship between media use during academic activities and academic performance. Studies on personality characteristics indicated that introverts perform worse than extroverts when exposed to television while reading (Furnham et al., 1994; Ylias & Heaven, 2003). Ylias and Heaven (2003) also examined four other personality characteristics (neuroticism, agreeableness, conscientiousness, and openness) but found that none of these characteristics moderated the relationship between multitasking and performance. Finally, several individual difference factors that are directly related to academic performance have been examined, such as level of expertise (Lin, Robertson, & Lee, 2009), interest level (Conard & Marsh, 2014), and self-regulation (Parks-Stamm, Gollwitzer, & Oettingen, 2010). These studies have indicated that when youth show lower levels of expertise and self-regulation media multitasking interferes more with their academic performance. Interest level, however, does not moderate the effects of media multitasking on academic performance.

Although some studies have examined individual differences related to the academic context, other possible individual differences that may moderate the relationship between media multitasking and youths' functioning have been widely ignored. The available studies have often found small to moderate negative relationships, possibly as a result of individual differences, as some individuals may be more susceptible to media multitasking effects than others (Valkenburg & Peter, 2013). To increase our understanding of the influence of media multitasking on youths' functioning, we need to identify which individuals are more susceptible to these effects by examining, for example, demographic (e.g., age and gender) and dispositional moderators (e.g., sensation seeking and impulsivity).

In addition to individual differences, contextual differences may also explain the differences in the consequences of media multitasking. To date, studies have only focused on contextual factors that are related to the academic context. For example, studies have focused on contextual factors, such as task relevance (Srivastava, 2013), task difficulty (Fox et al., 2009; Pool et al., 2000), and note-taking (Subrahmanyam et al., 2013; Wei et al., 2014). Although task difficulty does not moderate media multitasking effects on academic

performance, the studies have indicated media multitasking is more disruptive when task-relevance is high and youth do not engage in note-taking. However, future research should, for instance, also investigate which types of media may be particularly disruptive. For example, it is conceivable that media on digital mobile devices (e.g., text-messaging and social media platforms) are especially disruptive due to their ubiquitousness and highly disruptive potential through beeps, alerts, and pop-ups.

Including representative samples. Although concerns regarding media multitasking primarily focus on adolescents, only a few studies have actually investigated adolescents. Moreover, an important shortcoming of the existing studies is the inclusion of unrepresentative samples. Most studies of emerging adults are small and included only students from one specific university with a wide age range. Media multitasking and its effects may, however, differ by age. For instance, self-regulatory skills continue to develop throughout adolescence (Steinberg, 2004). Adolescents may therefore be less able to self-regulate their media multitasking behaviors than college students, which could result in higher levels of media multitasking in adolescence than in emerging adulthood. In addition, we observed high levels of gender bias within studies, often characterized by an overrepresentation of girls. Previous research highlighted that media use and its effects could differ for gender (Valkenburg & Peter, 2013). Therefore, to improve our understanding of media multitasking effects on youth, we need more representative samples of youth.

Conclusion

Researchers often implicitly or explicitly state that media multitasking has negative effects on youths' functioning. After carefully integrating the existing studies, the weight of evidence appears to support a small to moderate negative relationship between media multitasking and the three domains of youths' functioning. However, some studies found no significant relationship and evidence regarding the causality of this relationship is still lacking. Therefore, a more nuanced view of the negative effects of media multitasking on youths' functioning is needed. Future research should particularly focus on building more targeted theories, examining moderators, and establishing causality.

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