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Active on Facebook and failing at school? Meta-analytic findings on the relationship between online social networking activities and academic achievement

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Abstract The popularity of social networking sites (SNSs) among adolescents and young adults has raised concerns that the intensity of using these platforms might be associated with lower academic achievement. The empirical findings on this issue, however, are anything but conclusive. Therefore, we present four random-effects meta-analyses including 59 independent samples (total *N* = 29,337) on the association between patterns of SNS use and grades. The meta-analyses identified small negative effects of $\hat{\rho}$ = -.07, 95% CI [-.12, -.02] for general SNS use and $\hat{\rho}$ = -.10, 95% CI [-.16, -.05] for SNS use related to multitasking. General SNS use was unrelated to the time spent studying for school ($\hat{\rho}$ = -.03, 95% CI [-0.11, 0.06]) and no support for the time displacement hypothesis could be found in a meta-analytical mediation analysis. SNS use for academic purposes exhibited a small positive association, $\hat{\rho}$ = .08, 95% CI [.02, .14]. Hypotheses with regard to cross-cultural differences were not supported.

Keywords social networking sites, Facebook, academic achievement, grades, meta-analysis, time displacement

In the last ten years, online social networking sites (SNSs) such as Facebook, Twitter, or Instagram have become immensely popular. Facebook alone has reached a record number of 1.65 billion active users worldwide and, according to the company, the average user spends around 50 minutes per day on Facebook's platforms (Stewart, 2016). To no surprise, the correlates and consequences of SNS activities

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are among today's most debated questions among social scientists, journalists, and the general public alike. One of the key issues in the educational realm is the relationship between a student's use of SNSs and his or her achievement at school. Are heavy users of SNSs underperformers? So far, theoretic accounts as well as prior empirical studies on SNS activities and school achievement are not conclusive. Some have identified negative relationships between SNS use and grades (e.g., Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013; Sendurur, Sendurur, & Yilmaz, 2015), whereas others found positive relationships (e.g.,; Asante, & Martey, 2015; Leung, 2015) or no relationships at all (e.g., Brubaker, 2014; Huang, 2014). The current work provides the first systematic summary of respective empirical research findings. We present three meta-analyses on the relationship between different types of SNS use and academic achievement. Our first meta-analysis is focuses on general SNS use, the second meta-analysis focuses on multitasking with SNS, and the third meta-analysis summarizes findings on SNS use for academic purposes. A fourth meta-analysis and a meta-analytical mediation analysis address the time spent studying and its relationship to SNS use. Moreover, we investigate the moderating role of the developmental status of the country in which the study was conducted.

SNS Activities and Students' Academic Achievement

Much of the initial research on the impact of the Internet more generally, and SNSs more specifically, emphasized the challenges and problems associated with these activities (cf. Bargh & McKenna, 2004; Chou, Condron, & Belland, 2005). Time displacement and multitasking are two main theoretical approaches that suggest a negative association between SNS activities and success at school.

From a time displacement perspective (Nie, 2001; Putnam, 2000; cf. Tokunaga, 2016) the time spent with SNSs is unavailable for supposedly more desirable behavior (such as learning or physical activities) that would have otherwise occurred. Based on this line of thinking, the time invested in using Facebook or Instagram must be traded off against time spent on other activities. SNS activities therefore impair academic achievement by reducing the time spent for knowledge acquisition such as the time for preparation for school and homework (e.g., Kirschner & Karpinski, 2010). From this perspective, SNS activities are conceptually similar to other pastime activities such as watching TV or playing sports. Findings on the relationship between intensive use of SNSs (e.g., time spent, frequency of logins) and the time spent for studying have been ambiguous, however. Whereas some scholars found a negative association (e.g., Brubaker, 2014), others' findings were mixed (e.g., Karpinski, 2013; Ozer, 2015). Thus, despite the intuitive appeal of the time displacement hypothesis to many (e.g., Salmon, 2014) related evidence is contested.

A second perspective suggesting a negative link between SNS use and school success is theory and research on multitasking, that is, the use of SNSs while other activities take place. Of particular relevance to school success are SNS activities that occur during knowledge acquisition such as instruction at school, homework, or studying. From this perspective, the emphasis is less on social media replacing the time spent for preparation and study (time displacement), rather, concurrent SNS activities are assumed to decrease the effectiveness of studying. SNSs distract by providing the affordance to check messages or news, and to communicate, which reduces the situational working memory capacity that can be used for the primary task at hand (van der Schuur, Baumgartner, Sumter, & Valkenburg, 2015; Wood et al., 2012).

In addition, scholars have argued that SNS behaviors likely reduce the quality and quantity of sleep (cf. Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). Cross-sectional data of young adults revealed an association between the duration and frequency of SNS use and sleep disturbance (Levenson, Shensa, Sidani, Colditz, & Primack, 2016). Participants in the highest quartile of daily SNS activities (vs. participants in the lowest quartile) were about twice as likely to self-report sleep disturbances. Sleep, in turn, is a well-established predictor of scholastic achievement (e.g., Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010). SNS activities were related to increases in stress (Fox & Moreland, 2015), which would negatively affect sleep (e.g., Pillai, Roth, Mullins, & Drake, 2014), and stress is likely a direct predictor of impairments on demanding cognitive activities at home or at school (e.g., Kirschbaum, Wolf, May, & Wippich, 1996).

Fewer theoretical and empirical works emphasized the potentially positive association between SNSs activities and academic achievement. SNSs have been linked to social capital (e.g., Ellison, Steinfeld, & Lampe, 2007; Resnik, 2001), that is, a network of relationships between people that is used as a support for the achievement of individual or collective goals (Coleman, 1988). Higher social capital is associated with greater academic achievement (Eckles & Stradley, 2012). Engaging in SNSs can be a means to create a network that provides information and support and thus leads to positive academic outcomes (Johnson, 1981; Yu et al., 2010).

Therefore, depending on the theoretical perspective taken, the association between academic achievement and SNS activities could be negative or positive. These contradicting theoretical accounts are also reflected in the available research findings on the academic consequences of SNS use. Empirical research provided evidence for negative (e.g., Karpinski et al., 2013) as well as positive (e.g., Leung, 2015) and no associations (e.g., Pasek, More, & Hargittai, 2009).

The Current Meta-Analyses

Given the conflicting findings on the academic outcomes associated with intensive SNS use, the aim of the current work was to provide a meta-analytic overview of studies reporting on the associations between SNSs activities and indicators of school achievement such as the grade point average (GPA). In this regard, we pursued three objectives: First, we aimed at identifying the overall effect size to determine whether SNS use, on average, has the hypothesized negative relationship with academic outcomes (e.g., Karpinski et al., 2013) or rather a positive relationship as claimed by others (e.g., Leung, 2015).

Second, we examined two moderating influences – the type of SNS activity as well as cross-cultural differences – that might account for the divergent research findings in the published literature. We distinguished *a priori* between three patterns of SNSs use, a) general SNS use (such as time spent per day; frequency of posting with unspecified content), b) SNS use related to multitasking (e.g., using SNSs while studying), and c) SNS use in support of knowledge acquisition (e.g., using SNSs to communicate about school-related topics). Whereas the latter was assumed to have positive association with grades, we expected negative associations for the other SNSs activities. Therefore, we conducted three independent meta-analyses, one for each pattern of SNSs use, to identify their unique associations with school achievement as indicated by GPA or grades.

We also took a closer look at the regional origin of the sample. We assumed that for individuals in regions with lower socioeconomic development (as indicated by the Human Development Index [HDI]), general SNS use intensity could reflect access to educational resources, whereas intensity of SNS use is less likely an indicator of access to educational resources in highly developed countries (Sobaih, Moustafa, Ghandforoush, & Khan, 2016). Thus, the relationship between general SNS use and academic achievement should be more positive in less developed countries than in highly developed countries.

We further conducted several sensitivity analyses. In addition to publication year and the sample's age, we analyzed the potential influence of the measure of academic achievement (self-reported vs. documented grades). Although self-reported grades were found to be highly correlated with actual grades in prior research (Kuncel, Credé, & Thomas, 2005; Shaw & Mattern, 2009), they tend to be less reliable indicators for students with low ability than for high performing students. We therefore saw a need for a closer investigation of this variable and investigated whether the academic grade measure could influence the relationship between SNS use and academic achievement. Moreover, we performed tests for publication bias to examine the robustness of our findings.

Third, we investigated the time displacement hypothesis in greater detail (Nie, 2001; Putnam, 2000) and examined whether SNS use replaced time for learning activities and school preparation (study time). To this end, a meta-analytic structural equation model (Cheung, 2015) tested the implied mediation effect of study time on the SNSs-GPA link. Overall, the current work addresses an important research lacuna and provides the first systematic quantitative synthesis of the empirical findings on the academic associations of intensive SNSs use.

Method

Meta-Analytic Database

Search process. Relevant studies were identified from searching the PsychINFO and ERIC databases combining the search terms "Facebook", "social network sites", "Twitter", "Instagram", "Myspace", "Weibo", "Renren", "StudiVZ", or "Google+" and "school achievement", "academic achievement", "success", "performance", "GPA", or "grades". Additional studies were retrieved from a similar search in Google Scholar. We also checked the references of all relevant articles and asked for additional studies or datasets via e-mailing lists and forums of different organizations in the fields of psychology and education (see Figure 1 for a flowchart of our search process). This resulted in 765 potentially relevant studies.

Inclusion criteria. Studies included in the meta-analytic database had to meet the following criteria: (a) The study contained a measure of SNS behavior (e.g., a measure of frequency, intensity, or specific activities), (b) the study included a measure of achievement at school in the form of GPA or grades, and (c) the sample size and a measure of association (i.e., a correlation or regression coefficient) between SNS use and academic achievement were reported. Studies that included only Internet-related activities but not necessarily SNS-related activities (e.g., general Internet use, instant messaging, online gaming) were excluded as were measures that did not address SNS use but rather the motivation to use SNSs or attitudes towards SNSs. Comparisons between SNS users and non-users (e.g., being a member in one or more SNSs) were also not considered. Moreover, studies with measures on cognitive performance (e.g., intelligence test scores) rather than school grades were not included in the analyses because grades and cognitive abilities are only moderately correlated and represent unique constructs (Poropat, 2009; Richardson, Abraham, & Bond, 2012).

For potentially eligible studies that did not report relevant information or that reported conflicting information, we contacted the respective authors and included the study whenever the missing information could be obtained. After applying these criteria, we identified 50 publications reporting on 59 independent samples. Of these publications, 46 were included in the meta-analysis on general SNS use (55 samples), eight publications were included in the meta-analysis on multitasking SNS use (15 samples), and nine publications (ten samples) were included in the meta-analysis on using SNS use for academic purposes. Table 1 provides an overview of all independent samples included in our analysis. In the included studies students typically answered questions about their use of SNSs with the help of paper-and-pencil questionnaires or through online surveys. In around two thirds of the studies the students further reported on their academic success, with the large majority of surveys asking for GPA. In one third of the studies grades were obtained from school records.

Coding process. In the first step, the authors developed a coding protocol that defined all relevant information to be extracted from each publication and gave guidelines concerning the range of potential values for each variable. Then, two coders were trained who independently extracted the relevant data (i.e., effect sizes, descriptive information, moderator variables) from each publication.

Effect sizes between students' SNS use and their grades were coded (correlation coefficients, if unavailable then standardized regression weights were used). The respective intercoder reliability for these effect sizes was Krippendorff's (1970) $\alpha = 1.00$ (based on a subset of 120 effect sizes). Moreover, effect sizes pertaining to the relationship between SNSs use and time spent on learning (study time) as well as between time spent on learning and academic performance were retrieved. The intercoder reliability for these effect sizes was again very good with Krippendorff's (1970) $\alpha = 1.00$.

We further coded the operationalization of the SNS activity and distinguished between a general use of SNS, a multitasking way of SNS use, and SNS use for academic purposes. Measures of general SNS use were defined as measures of SNS use with no specified connection to school or academia (e.g., time spent on SNS). Measures of multitasking SNS use were defined as measures that asked for SNS activities that occurred during times of instruction or preparation but were unrelated to the content of the instruction (e.g., checking news on SNSs at times of homework). Measures of SNS use for academic purposes were defined as measures of SNS activities meant to support knowledge acquisition (e.g., using a Facebook group to discuss learning matter). In addition, we extracted several variables for our moderator and sensitivity analyses. The economic and social developmental status of the country in which the study was conducted was coded with the help of the four categories of the Human Development Index (HDI, United Nations Development Program, 2014, see supplementary material). We further coded the publication status (published vs. unpublished studies) and type of academic achievement measure (self-reported vs. documented). Because 26 studies did not report the mean age of the respondents, we coded the sample background in two categories (adolescents vs. undergraduates). Finally, the recency of the findings (i.e., publication year) was coded and analyzed as a continuous variable.

Meta-Analytic Procedure

The meta-analyses were conducted following the guidelines of the PRISMA statement (Moher, Liberati, Tetzlaff, & Altman, 2009) as well as standard procedures and recommendations for the social and medical sciences (Lipsey & Wilson, 2001).

Effect Size. In each meta-analysis, the zero-order Pearson product moment correlation was the focal effect size. All correlations were coded in a way that positive correlations reflect a finding that students who use SNSs more intensively do better at school or college than students who use SNSs less. For studies that only reported standardized regression weights from multiple regression analyses (and zero-order associations could not be obtained by contacting the researchers) correlation coefficients were approximated using the formula in Peterson and Brown (2005). Although this approach is discussed controversially (see Rosenthal & DiMatteo, 2001; Ferguson, 2015; Rothstein & Bushman, 2015), excluding these effects would reduce the power of our analyses and, if reporting standards were systematically associated with the size of the effects, bias our meta-analytic results. Therefore, we included these effects sizes (see also, for example, Allen, Walter, & McDermott, 2017; Robles, Slatcher, Trombello, & Mcginn, 2014; van Geel, Vedder, & Tanilon, 2014) and conducted sensitivity analyses to evaluate their impact on the pooled correlation. If a study reported multiple effect sizes for two or more eligible associations (e.g., scores for two general SNS use measures were each correlated with GPA) these effects were averaged to guarantee independence of effect sizes.

Univariate Meta-Analyses. The effect sizes were pooled using the random-effects approach proposed by Hedges and Vevea (1998). Following standard procedures, the correlations were converted into a standard normal metric using a Fisher's *Z* transformation and converted back for the presentation of the results. To account for sampling error, each effect size was weighted by the inverse of its variance. The homogeneity of the effects sizes was tested using the χ^2-distributed *Q*-statistic (Cochran, 1954). Because this test frequently exhibits a rather poor power (e.g., Sánchez-Meca & Marín-Martínez, 1997), we more strongly relied on I^2 that indicates the percentage of the total variance in observed effects due to random variance (Higgins, Thompson, Deeks, & Altman, 2003). Prevalent rules of thumb suggest that I^2 of .25, .50, and .75 indicate low, medium, and high heterogeneity, respectively. Categorical moderators were evaluated with subgroup analyses, whereas continuous moderators were examined using meta-regression analyses (Hedges & Pigott, 2004). The meta-analytic models were estimated with the software *Comprehensive Meta-Analysis, Version 2* (Borenstein, Hedges, Higgins, & Rothstein, 2005).

Meta-Analytic Structural Equation Analysis. The mediation effect implied by the time displacement hypothesis was examined by extending the univariate meta-analyses to a meta-analytic structural equation model (MASEM; Bergh et al., 2016; Cheung, 2015). To this end, three univariate meta-analyses (see above) were conducted that derived the pooled associations between general SNS use and GPA, general SNS use and study time, as well as study time and GPA. Subsequently, the correlation matrix formed by these pooled correlations was subjected to a conventional path analysis in *lavaan* version 0.5-23.1097 (Rosseel, 2012) using a maximum likelihood estimator. This analysis specified two regressions representing the hypothesized mediation effect: GPA was regressed on SNS use and study time, whereas study time was regressed on SNS use. This analysis used the smallest total sample size from the three meta-analyses for the calculation of the parameters' standard errors (and consequently the significance tests).

Publication Bias. A potential publication bias was examined in three ways: First, we compared effects from published studies (e.g., in journal articles or books) to effects from unpublished studies (e.g., in theses or conference proceedings) to examine whether systematically different effects were reported. Second, a regression test (Egger, Smith, Schneider, & Minder, 1997) was used to test for funnel plot asymmetry, an indicator of small study effects. Third, we estimated the number of studies with null-effects that needed to be included in the meta-analysis for the pooled effect to become non-significant (Rosenthal, 1979).

Results

General SNS Use and Academic Achievement

Pooled effect. The average effect of the relationship between general SNS use and academic achievement over k = 55 independent samples was $\hat{\rho} = -.07$, 95% CI [-0.12, -0.02] (Table 2). Thus, more intensive general SNS use was associated with significantly lower academic achievement. However, there was substantial heterogeneity between the effect sizes, I^2 = 93.30, Q (54) = 805.95, p < .001. About 93% of the observed variance in the effect sizes was due to differences between samples rather than sampling error. We assumed that the developmental status of the country in which the study was conducted would predict the association between general SNS use and achievement. Among the studies included in our analysis 36 out of 55 were conducted in very highly developed countries (e.g., USA, Australia). Ten samples originated from highly developed countries (e.g., China, Thailand) and nine from medium or low developed countries (e.g., South Africa, Ethiopia). In contrast to our predictions, the developmental status did not influence our findings, Q (2) = 0.64, p = .73 (see Table 3).

Analyses of sampling bias. A common problem for meta-analyses is the fact that studies with small sample sizes, non-significant effects, or even contradictory effect directions are often not published and hard to find. This could lead to an overestimation of the meta-analytic effect size. To identify such *small studies effects* we first plotted the effect sizes against the standard error of the studies. A visual inspection of the funnel plot did not suggest a small study effect (see supplementary material for the funnel plots). Moreover, the regression test was not significant, B = -0.73, SE = 1.27, 95% CI [-3.28; 1.81], p = .57, further corroborating the finding of no substantial publication bias. A fail-safe N analysis (Rosenthal, 1979) indicated that 1,124 unpublished studies with a null effect would be needed to reduce the p-value to non-significance. More than one third of our studies were unpublished, so we compared published with non-published effects. This analysis yielded a non-significant difference, Q (1) = 1.64, p = .20, showing that the effect sizes did not systematically depend on the publication status. In sum, we found no indication of substantial publication bias.

Sensitivity analyses. We conducted several additional analyses to examine the robustness of our findings (see Table 3). The sensitivity analyses included the type of academic achievement measure (self-reported vs. documented), type of effect size reported (correlational data vs. regression weights), the sample background (adolescents vs. undergraduates), and the year of publication. We found a significant difference between studies that were based on self-reported achievement measures (k = 41) as compared to studies that were based on documented grades (k = 14), Q (1) = 7.27, p < .01. The former had a significantly negative relationship with general SNS use on average, $\hat{\rho} = -.09$, 95% CI [-0.15, -0.03], p <

.01, whereas studies that were based on documented achievement showed a non-significant effect, $\hat{\rho} = .01$, 95% CI [-0.02, 0.04], *p* = .60. Moreover, studies that were based on zero-order correlations (*k* = 41) differed from studies that reported regression analyses and thereby controlled for other variables (*k* = 14), *Q* (1) = 7.27, *p* < .01. Studies that reported zero-order correlations yielded a significantly negative relationship between academic achievement and general SNS use, $\hat{\rho} = -.11$, 95% CI [-0.17, -0.05], *p* < .01, whereas studies that reported regression weights yielded no significant relationship, $\hat{\rho} = .03$, 95% CI [-0.05, 0.11], *p* = .45. Sample age (adolescents vs. undergraduates) did not affect the average association between academic achievement and general SNS use. Likewise, the publication year had no effect on the results, *B* = -.003, *SE* = .003, 95% CI [-0.010, 0.003], *p* = .32.

Multitasking SNS Use and Academic Achievement

Pooled effect. The average effect for the relationship between multitasking SNS use and academic achievement in *k* = 15 samples was $\hat{\rho} = -.10$, 95% CI [-0.16, -0.05] (Table 2). This indicates a small but significant negative association, suggesting that more SNS use in the form of multitasking goes along with lower school achievement. The homogeneity analysis yielded a significant effect, *Q* (14) = 83.40, *p* <.001, showing heterogeneous effect sizes. Quantifying this heterogeneity with I^2 = 83.21 indicated that 83% of the variance in the effect sizes was due to differences between samples rather than sampling error. However, the developmental status of the study countries showed little variation. The majority of studies were conducted in countries with very high development (*k* = 14), one study was conducted in a country with high development. As a consequence, no significant moderating effects of the countries' developmental status could be identified (see Table 4).

Analyses of sampling bias. To identify a potential small studies effect we again plotted the effect sizes against the standard error. The funnel plot showed that most of the studies with large sample sizes and were located around the mean effect, and the funnel plot did not suggest a small studies effect regarding multitasking SNS use and academic achievement. Egger's regression test amounted to *B* = -1.31, *SE* = 1.68, 95% CI [-4.95, 2.33], *p* = .45, supporting the assumption of no publication bias. A fail-safe *N* analysis indicated that 236 studies with a null effect would be needed to reduce the *p*-value of the average effect size to be non-significant. The effect size did not systematically depend on the publication status, *Q* (1) = 0.01, *p* = .94. Published studies (*k* = 10) yielded similar results as unpublished work (*k* = 5). No indication of substantial publication bias was found.

Sensitivity analyses. As in the previous meta-analysis, we examined the type of achievement measure (self-reported vs. documented), reported effect size (correlational data vs. regression weights), sample background (adolescents vs. undergraduates/adults), as potential moderators explaining the heterogeneity between samples. None of these factors significantly affected our results (see Table 4). We conducted a meta-regression to analyze publication year as a potential continuous factor, and found a significant trend over time, *B* = -.021, *SE* = .008, 95% CI [-.036, -.006], *p* = .006. The association between SNS multitasking and academic achievement was more negative in the more recent studies. This finding is based on 15 independent samples from work published between 2009 and 2015, thus, the rather small database precludes too bold conclusions. That said, this trend could reflect a rise in students' multitasking and the related association with student grades during a time in which smartphones have become ubiquitous for students, and SNSs can be accessed more easily at times and in places of preparation and instruction.

SNS Use for Academic Purposes and Academic Achievement

Pooled effect. The average relationship between SNS use for academic purposes and academic achievement over *k* = 10 independent samples was $\hat{\rho} = .08$, 95% CI [0.02, 0.14] (Table 2). Thus, the results showed a significant effect in the positive direction, indicating that academic achievement is positively related to intensive SNS use, as long as SNSs are used for academic purposes. A test of homogeneity showed a significant result of *Q* (9) = 19.37, *p* = .02, that indicates a variation of the effect sizes between samples, I^2 = 53.53. Therefore, we also conducted a moderator analysis for the developmental status of the country the study was conducted. Only very highly developed countries (*k* = 7) and highly developed countries (*k* = 3) were present, yielding no significant difference, *Q* (1) = 0.021, *p* = .89 (see Table 5).

Analyses of sampling bias. To identify a small sample effect we plotted the effect sizes against their standard errors. The funnel plot showed no systematic asymmetry. Egger's regression test was *B* = 2.17, *SE* = 1.45, 95% CI [-1.18; 5.52], *p* = .173, which also supported the assumption of non-existing publication bias. A fail-safe *N* analysis indicated that 24 studies with null effects would be needed to reduce the *p*-value of the average effect size to be non-significant. The publication status did not significantly influence the results, *Q* (1) = 0.69, *p* = .41. Published studies (*k* = 5) yielded similar results as unpublished work (*k* = 5). In sum, none of our indicators showed a noteworthy sign of publication bias.

Sensitivity analyses. Sensitivity analyses for the type of academic achievement measure (self-reported vs. documented), and type of effect size reported (correlational data vs. regression weights) identified no significant differences between these contextual conditions (Table 5). The age group showed little variance with all but one sample consisting of undergraduates. Year of publication had no influence on the results, *B* = -.008, *SE* = .013, 95% CI [-.033, .017], *p* = .52.

Examining the Time Displacement Hypothesis.

Pooled effects. The time spent on learning and school preparation was expected to mediate the effect of general SNSs use on academic performance. Therefore, three univariate meta-analyses were conducted that quantified the associations between SNSs use, GPA, and study time. The pooled effect for the relationship between general SNS use and academic achievement was previously estimated as $\hat{\rho} = -.07$ (see above). Moreover, the average relationship between study time and academic achievement over *k* = 14 independent samples was estimated as $\hat{\rho} = .15$, 95% CI [0.06, 0.25] (Table 2). Thus, study times were significantly associated with academic achievement. In contrast, general SNSs use did not exhibit respective associations with study times. The average relationship between general SNS use and study time over *k* = 10 independent samples was $\hat{\rho} = -.03$, 95% CI [-0.11, 0.06] (Table 2).

Meta-Analytic Structural Equation Model. Based on the pooled correlations reported in the previous section, we estimated the mediation model presented in Figure 2. In line with the univariate meta-analyses, SNSs use (β = -.07, *SE* = .01, *p* < .001) and study time (β = .15, *SE* = .01, *p* < .001) had significant main effects on GPA. However, there was no indirect effect of SNSs use on GPA via study time (*B* = -.00, *SE* = .00, *p* = .17). These results offer no support for the time displacement hypothesis.

Discussion

Social Networking Sites (SNSs) have become a mainstay in the lives of many adolescents and adults worldwide. With the growing popularity of SNSs, teachers, parents, and popular media have expressed worries regarding the academic consequences of students being active on Facebook, Instagram, and other SNSs, and SNSs have been blamed for students' bad grades (Bloxham, 2010; Trapp, 2016). Theoretical perspectives have highlighted the risks as well as the opportunities of SNSs in the academic realm. Empirical studies that connected measures of SNS use on the one hand and achievement-related variables on the other yielded conflicting evidence (e.g., Junco, 2012a; Khan et al., 2014; Kirschner & Karpinski, 2010; Hargittai & Hsieh, 2010). Against this background, the aim of the current work was to provide a quantitative, meta-analytic summary of the empirical findings on the relationship between the intensity of SNS activities and school achievement. We distinguished a priori between three aspects of SNS use, general SNS use (such as time spent per day; frequency of posting with unspecified content), SNS use related to multitasking (e.g., using SNSs while studying), and SNS use connected to preparation and learning for school (e.g., using SNSs to communicate about school-related topics). Based on these three groups of activities, three separate meta-analyses were conducted. A fourth meta-analysis and a subsequent mediation analysis examined the influence of SNS use on the time spent on studying, a supposed mediator to explain a negative link between SNS use and achievement (time displacement hypothesis).

As expected, we identified a positive relationship between school-related SNS use and academic achievement. The more active students are in school-related SNS activities the better are their grades. However, albeit significant, the respective correlation was rather small ($\hat{\rho} = .08$), following Cohen's (1992) often-cited framework for interpreting effect sizes. Similar, in Hattie's (2011; 2015) highly cited summary of meta-analyses on influences related to student achievement, effects up to *r* = .10 were well-below the average effect (*r* = .20) and were considered negligible, not worth wasting educators' time. Our meta-analytic assessment of the association between school grades and multitasking SNS activities showed an association of similar size, however, in the negative direction ($\hat{\rho} = -.10$). In line with prior theory (e.g., van Schuur et al., 2015), using SNSs for non-academic purposes at times of preparation and learning was related to lower school grades. A similar relationship was found in our largest dataset that relied on measures of general SNS use, such as the time spent with SNSs per day or the frequency of log-ins. The average association between achievement and general SNS use amounted to $\hat{\rho} = -.07$ indicating that overall SNS use was significantly, but weakly, associated with lower academic achievement.

We further provided the first meta-analytical assessment of the time displacement hypothesis. We found no significant association between general SNS use and the time spent studying, and consequently time spent studying did not serve as a mediating variable of the association between general SNS use and achievement. Based on these results we conclude that the current empirical literature is in no support of the time displacement hypothesis.

In all three meta-analyses that related SNS activities to school grades, substantial heterogeneity between the effect sizes was observed that could not be accounted for by mere sampling error. Therefore, a further objective was to identify variables that might help explaining variations in the association between SNS use and academic achievement. Over and above our separate analyses of general, multitasking, and academic use of SNSs, we investigated whether the cultural background of a sample moderated the effects. We assumed that the intensity of SNS activities would reflect the access to informational resources in samples outside the very highly developed Western countries. Thus, in less developed countries, more positive relationships between general SNS use and achievement should be observed. However, the countries' developmental status (as indicated by the HDI; United Nations Development Program, 2014) did not predict the association between SNS use and academic achievement. Although our study sample did include studies that were conducted in countries with low or medium developmental status (such as Nigeria, Ethiopia, Ghana, Jordan, or Malaysia) these were few and the majority of research was conducted in the US and other very highly developed countries (e.g., Sweden, New Zealand). This limitation has reduced the chance of identifying meaningful differences. Moreover, the null effect could have been due to a generally high socio-economic status of the students who participated in the primary studies, irrespective of a country's HDI. When only high socioeconomic status students were included in the study, high access to informational resources would be expected for all participants.

However, our sensitivity analyses yielded four remarkable results. First, studies that utilized a self-report measure as the indicator of school achievement showed a significantly negative relationship between general SNS use and achievement, whereas studies that utilized documented grades as the indicator of school achievement identified almost a null-effect. This finding is noteworthy, as prior research suggests that self-reported grades are highly correlated with real, documented grades (Kuncel, Credé, & Thomas, 2005; Shaw & Mattern, 2009). If, however, self-reported and documented grades diverge, students tend to underreport rather than overreport their grades. One possible reason for the difference between studies using self-reported versus documented grades could be a stronger social desirability bias in the former set of studies (see Cole & Gonyea, 2010). Individual differences in social desirability could potentially lead to higher self-reported grades (e.g., less underreporting) and lower self-reported SNS use, resulting in a spurious relationship between these variables. Thus, despite the small negative association observed in the overall sample it is conceivable that SNS activities actually do not have any relationship with academic outcomes at all.

We further examined effect size differences between studies that reported zero-order correlations and studies that reported beta coefficients, with the latter controlling for third variables as part of a multiple regression. The results highlighted that studies that reported zero-order correlations showed a significant average effect, whereas studies that reported the standardized beta-weights showed no average relationship. We transformed beta weights with the help of a formula by Peterson and Brown (2005), which is a common procedure in meta-analytic research. Whether or not betas should be included in a meta-analysis in the first place is a matter of ongoing debate, however, some argue for inclusion (e.g., Rosenthal & DiMatteo, 2001; Ferguson, 2015), others are more critical (e.g., Rothstein & Bushman, 2015). Third, our analysis of multitasking SNS use and achievement showed that the relationship was more negative in more recent studies. This finding, despite being based on a rather small number of studies, could reflect the rise of mobile Internet access and the proliferation of mobile SNS activities. As of fall 2016, 92% of Facebook's active monthly users access the platform at least sometimes with a mobile device and more than 50% of the active users access the platform with a mobile device exclusively (Facebook, 2016). Thus, SNS multitasking has become a possibility everywhere in students' homes, libraries, and schools. From this perspective, the average meta-analytical relationship between multitasking SNS use and achievement presented here (i.e., work published from 2009 to 2015) could be slightly lower than the association expected for today's students who live in a smartphone-saturated environment.

Finally, the observed heterogeneity in effect sizes could be partially attributed to the age group the study was based on. Whereas studies with undergraduates showed a negative relationship between general SNS use and academic achievement ($\hat{\rho} = -.08$), there was no such association in studies with adolescents ($\hat{\rho} = .01$). Thus, negative associations observed for older participants are absent in the group of adolescents. So far, it is unclear whether these differences are due to age effects or rather systematic cohort differences. Much of the recent journalistic discourse in the field is focused on the cohort of post-millenials (*Generation Z*, e.g., Williams, 2015), and their supposedly unique psychological responses to new media technologies. Little scientific evidence is available to back these supposed cohort effects. Despite these intriguing moderating effects, it should be kept in mind that we had no *a priori* hypotheses guiding these analyses. Therefore, these exploratory analyses should be extended in future research that, for example, explicitly accounts for the potentially confounding influence of social desirability bias in SNS research or disentangles potential age effects from cohort differences.

Limitations and Directions for Future Research

Some limitations might compromise the generalization of our findings thereby pointing out the need for additional research. First, the cross-sectional design of the pooled primary studies prohibits causal interpretations of our results. Do SNSs activities result in poorer academic achievements or, rather, are academic underperformers more likely to engage in SNSs? Causal conclusions require longitudinal studies examining how the interplay between SNSs use and academic achievements evolves over time. However, the limited longitudinal evidence that is available so far (e.g., Leung, 2015) corroborated a positive effect of general SNSs use on changes in overall grades within one year. Moreover, all previous research was limited to the examination of linear associations between SNSs activities and academic achievement. However, it is conceivable that moderate degrees of SNSs use might be harmless and yield no detrimental effects, whereas an excessive time spent on Facebook or related platforms result in more negative consequences—for example, excessive SNSs use has been associated with addiction symptoms and clinical disorders (e.g., Kuss & Griffiths, 2011a; 2011b; see Gnambs & Appel, 2017a, for an analysis of linear and non-linear relationships between gaming and intelligence). Future studies are encouraged to identify particularly harmful patterns of SNS use by examining linear as well as non-linear relationships.

Second, our meta-analyses identified a substantial amount of unaccounted variance between samples that could not be explained by the examined moderators. This opens intriguing possibilities for the identification of additional moderating influences. For example, it is reasonable to assume that intensive SNSs use has particularly adverse effects if parents neglect to monitor their children's studying times, particularly during examination periods, and do not track their academic progress. Today, little is known as to how SNS-related parenting (and media-related parenting more generally) affects achievement-related student behaviors or school achievement (cf. Nathanson, 2013). Moreover, students' own ability to regulate behavior could explain differences between samples and individuals (cf. Hofmann, Reinecke, Meier, & Oliver, 2017). Experience sampling data suggests that giving in to media desires is a common expression of self-control failure in everyday life (Hofmann, Vohs, & Baumeister, 2012). Using

SNSs for procrastination could not only explain lower well-being (Meier, Reinecke, & Meltzer, 2016) but the efficacy of studying and preparation for school exams and resulting grades. On the level of sample background, variables other than the HDI (which did not moderate our findings) could play a role (cf. Gnambs & Appel, 2017b). Theory-guided research on cultural differences could focus on Hofstede's cultural dimensions or Schwartz's value system (e.g., Hofstede, Hofstede, & Minkov, 2010; Schwartz, 2006) to explain the varying role of SNSs regarding educational outcomes.

Third, due to lack of primary studies that related SNS use to sleep or to stress in combination with school achievement, promising mediating paths as well as important moderating variables remain untested. Rather than the time spent studying, sleep quality and quantity could be a crucial link between SNS activities on school achievement. As a consequence, SNSs activities that take place during the nighttime should be more negatively associated with school achievement than similar activities during the afternoon. More studies with a fine-grained assessment of social media activities are needed to test this prediction, preferably using ambulatory assessment or time diary methods. The smartphone itself provides means not only to track social media activities, but to record sleep patterns (see Min et al., 2014, and Patel, Kim, & Brooks, 2017, for methodological challenges).

Conclusion

The current paper presented four meta-analyses on the relationship between SNS use and academic achievement. Our work underscores the notion that SNS use is positively associated with academic achievement as long as SNS use is school-related. This is in contrast to fears of many parents and teachers that the influence of SNS is inevitable detrimental for academic achievement. SNS use unrelated to school, however, was associated with poorer academic achievement. However, all correlations identified in these meta-analyses were rather weak, only a small part of students' achievement at school and university co-varied with SNS use. A meta-analytic investigation of the time displacement hypothesis found no support for the assumption that the intensity of social media activities is associated with less time spent for studying. Despite the proliferation of SNSs in societies around the world, social networking activities appear to be only weakly related to academic achievement.

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Table 1.

Main Characteristics of the Primary Studies

No.	Study	Sample; Origin	*N*	SNS Variable(s)	Academic achievement variable(s)	Effect size
1.	Abdulahi, Samadi, & Gharleghi, 2014	Mostly adults; Malaysia	152	Time spent on Facebook	Self-reported grades	-.37 (G)
2.	Abu-Shanab, & Al-Tarawneh, 2015	Adolescents; Jordan	113	Time spent on Facebook	Documented GPA	-.06 (G)
3.	Adebiyi et al., 2015	Undergraduates; Nigeria	239	Time spent on SNSs	Self-reported GPA	-.23 (G)
4.	Alexander, 2013	Adolescents; USA	72	Facebook Intensity Scale	Documented GPA	-.23 (G)
5.	Al-Menayes, 2015	Undergraduates; Kuwait	1,327	Time spent on SNS	Self-reported GPA	-.09 (G)
6.	Asante, & Martey, 2015	Undergraduates; Ghana	701	Multi-item general SNS use measure	Self-reported GPA	.42 (G)
7.	Brubaker, 2014	Undergraduates; USA	73	Time spent on Facebook; Facebook multitasking; Facebook to get help/help others with homework	Documented GPA	.03 (G) .02 (M) .06 (A)
8.	Cepe, 2014 Sample 1	Adolescents; New Zealand	106	Frequency of checking Facebook; time spent on Facebook	Self-reported grades	-.10 (G)
9.	Cepe, 2014 Sample 2	Undergraduates; New Zealand	211	Frequency of checking Facebook; time spent on Facebook	Self-reported grades	-.05 (G)
10.	Cohen, 2011	Undergraduates; USA	283	Frequency of checking Facebook	Self-reported GPA	-.14 (G)

11.	Golub, & Miloloža, 2010	Undergraduates; Croatia	277	Multi-item measure of Facebook use (several activities); Facebook multitasking with homework; Frequency of communication with professors/ on academic matters	Self-reported GPA	-.07 (G) -.06 (M) .08 (A)
12.	Gray et al., 2013	Undergraduates; USA	338	Multi-item measure of Facebook use (several activities); Facebook collaboration	Documented GPA	.05 (G) .13 (A)
13.	Hasnain, Nasreen, & Ijaz, 2015	Undergraduates; Pakistan	171	Multi-item measure of SNS use	Multi-item measure of academic performance (including self-reported GPA)	-.24 (G)
14.	Helton, 2011	Undergraduates; USA	199	Time spent on Facebook	Self-reported GPA	-.21 (G)
15.	Hirsh, 2012	Undergraduates; USA	44[b]; 116[c]	Time spent on SNS; quantity of tweets	Self-reported expected final grade[a]	.06 (G)
16.	Huang, 2014	Adolescents; China	1,535	Multi-item measure of SNS use (time spent and number of friends)	Self-reported grades	.01 (G)
17.	Hyatt, 2011	Undergraduates; USA	613	Time spent on SNS	Self-reported GPA	-.11 (G)
18.	Iorliam & Ode, 2014	Undergraduates; Nigeria	1,560	Time spent on Facebook	Self-reported GPA	-.32 (G)
19.	Jacobsen & Forste, 2011	Undergraduates; USA	1,026	Time spent on Facebook	Self-reported GPA	-.07 (G)
20.	Jamil et al., 2013	Undergraduates; Pakistan	275	Facebook Intensity Scale	Self-reported GPA	-.09 (G)
21.	Junco, 2015 Sample 1	University Freshmen; USA	437	Time spent on Facebook; Frequency of several Facebook activities; Facebook multitasking	Documented GPA	.01 (G) -.13 (M)

22.	Junco, 2015 Sample 2	University Sophomores; USA	401	Time spent on Facebook; Frequency of several Facebook activities; Facebook multitasking	Documented GPA	.04 (G) -.13 (M)
23.	Junco, 2015 Sample 3	University Juniors; USA	345	Time spent on Facebook; Frequency of several Facebook activities; Facebook multitasking	Documented GPA	.02 (G) -.14 (M)
24.	Junco, 2015 Sample 4	University Seniors; USA	406	Time spent on Facebook; Frequency of several Facebook activities; Facebook multitasking	Documented GPA	.02 (G) -.01 (M)
25.	Junco, 2012a	Undergraduates; USA	1,771 to 1,776[d]	Time spent on Facebook; Frequency of several Facebook activities	Documented GPA	.01 (G)
26.	Junco, 2012b	Undergraduates; USA	1,716	Frequency of Facebook multitasking in class	Documented GPA	-.02 (M)
27.	Junco, & Cotten, 2012	Undergraduates; USA	1,624	Frequency of Facebook multitasking with schoolwork	Documented GPA	-.06 (M)
28.	Karpinski et al., 2013 Sample 1	Undergraduates; USA	451	Time spent on SNS; SNS multitasking	Self-reported GPA	-.61 (G) -.28 (M)
29.	Karpinski et al., 2013 Sample 2	Undergraduates; EU	406	Time spent on SNS; SNS multitasking	Self-reported GPA	-.27 (G) .01 (M)

30.	Khan, Wohn, & Ellison, 2014	Adolescents; USA	690	Frequency of Facebook use; Several Facebook variables (including Number of Facebook friends[e]); Intensity of academic Facebook collaboration	Self-reported grades	.02 (G) .02 (A)
31.	Lampe et al., 2011	Undergraduates; USA	302	Facebook use for collaboration	Self-reported GPA[a]	-.01 (A)
32.	Lee, 2016	Undergraduates; Philippines	3,173[f]	Time spent on Facebook	Self-reported GPA	-.02 (G)
33.	Leelathakul, & Chaipah, 2013	Adolescents; Thailand	98	Multi-item measure of Facebook use (use for academic purposes; use for non-academic purposes)	Documented GPA[a]	-.10 (G) .17 (A)
34.	Leung, 2015	Adolescents; Hong Kong	718	Frequency of Facebook use	Self-reported overall grades	.10 (G)
35.	Michikyan, Subrahmanyam, & Dennis, 2015	Undergraduates; USA	256-261[d]	Time spent on Facebook; composite of Facebook activities	Self-reported GPA	.11 (G)
36.	Moon, 2011	Undergraduates; USA	204	Time spent on Facebook (several activities)	Self-reported GPA	-.13 (G)
37.	Negussie, & Ketema, 2014	Undergraduates; Ethiopia	394	Time spent on Facebook; Frequency of Facebook use	Self-reported GPA[a]	.28 (G)
38.	Ng et al., 2014	Adolescents; Malaysia	137	Time spent on Facebook	Documented GPA	-.02 (G)
39.	O'Brien, 2011	Undergraduates; USA	160	Time spent on Facebook; Frequency of Facebook use	Documented GPA	.06 (G)
40.	Ogedebe, Emmanuel, & Musa, 2012	Undergraduates; Nigeria	122	Time spent on Facebook	Self-reported GPA	.03 (G)
41.	Olufadi, 2015	Undergraduates; Nigeria	286	Time spent on SNS	Self-reported GPA	-.11 (G)

42.	Ozer, 2015 Pilot study Sample 1	Undergraduates; USA	444	Time spent on SNS; Frequency of SNS use; SNS multitasking	Self-reported GPA	-.46 (G) -.36 (M)
43.	Ozer, 2015 Pilot study Sample 2	Undergraduates; EU	346	Time spent on SNS; Frequency of SNS use; SNS multitasking	Self-reported GPA	-.15 (G) .00 (M)
44.	Ozer, 2015 Main study sample 1	Undergraduates; USA	226	Time spent on SNS; Frequency of SNS use; SNS multitasking; SNS use for school	Self-reported GPA	-.13 (G) .02 (M) -.01 (A)
45.	Ozer, 2015 Main study sample 2	Undergraduates; Turkey	200	Time spent on SNS; Frequency of SNS use; SNS multitasking; SNS use for school	Self-reported GPA	-.11 (G) -.10 (M) .01 (A)
46.	Pasek, More, & Hargittai, 2009 Sample 1[g]	Undergraduates; USA	1,049	Frequency of Facebook use	Self-reported GPA	.01 (G)
47.	Pasek, More, & Hargittai, 2009 Sample 2[h]	Undergraduates; USA	660	Frequency of Facebook use	Self-reported GPA	.12 (G)
48.	Ravizza, Hambrick, & Fenn, 2014	Undergraduates; USA	167	Multi-item measure of Facebook use (time spent and frequency)	Documented exam grade	-.10 (G)
49.	Rosen, Carrier, Cheever, 2013	Adolescents and Undergraduates; USA	263	Facebook multitasking (Use Facebook at least once in a 15 minute period on task/studying)	Self-reported GPA	-.23 (M)
50.	Rouis, 2012	Undergraduates; Tunisia	161	Multi-item measure of Facebook use (time spent, frequency and cognitive absorption)	Self-reported GPA	.10 (G)
51.	Rouis, Limayem, Salehi-Sangari, 2011	Undergraduates; Sweden	239	Multi-item measure of Facebook use (time spent and frequency)	Self-reported GPA	-.14 (G)
52.	Sendurur, Sendurur, & Yilmaz, 2015	Undergraduates; Turkey	406	Time spent on SNS	Self-reported GPA	-.23 (G)

53.	Sereetrakul, 2013	Undergraduates; Thailand	251	Time spent on Facebook; Facebook use for collaboration	Self-reported GPA	-.12 (G) .07 (A)
54.	Sinafar, Faridi, & Karamipour, 2016	Adolescents; Iran	103	Time spent on SNS	Self-reported GPA	-.01 (G)
55.	Swang, 2011	Adolescents; USA	130	Time spent on SNS	Self-reported GPA	-.10 (G)
56.	Walsh et al., 2013	Undergraduates; USA	483	Time spent on SNS	Self-reported GPA	-.06 (G)
57.	Wang, 2013	Undergraduates; Taiwan	134	Multi-item measure of Facebook use (Facebook games and non-gaming applications); Starting (school-related) projects on Facebook	Self-reported grades	-.22 (G) .35 (A)
58.	Yang et al., 2015	Undergraduates; USA	394	Number of Facebook friends; Number of Twitter Followers and Followings	Self-reported GPA	-.03 (G)
59.	Yu et al., 2010	Undergraduates; Hong Kong	187	Multi-item measure of SNS use (Time spent, number of friends)	Self-reported GPA	-.02 (G)

Notes. The studies were included in one, two, or all three meta-analyses: Effect size and (G) = included in meta-analysis on general SNS-use, effect size and (M) = included in meta-analysis on SNS multitasking, effect size and (A) = included in meta-analysis on SNS use for academic purposes. [a] Academic achievement measure not explicitly specified, but could be correctly categorized with a high probability; [b] Subgroup that used Twitter; [c] Whole sample, [d] Differences because of missing data; [e] Also included Facebook friends' instrumental support; Facebook class-related academic collaboration; [f] Results reported for *N* = 1,495 men and *N* = 1,678 women [g] University of Illinois at Chicago sample; [h]NASY (National Annenberg Survey of Youth), cross-sectional.

Table 2.

Meta-Analyses for Different Types of SNS Use

	Average Effect						Heterogeneity					
	k	*N*	Effect Size (ρ)	95% *CI*	*Z*	*p*	*Q*	*df* (*Q*)	*p*	I^2	τ^2	SE_{τ^2}
General SNS use and												
Academic achievement	55	25,432	-0.071	[-.121; -.020]	-2.73	.006	805.95	54	<.001	93.30	.033	.009
Learning time	10	3,130	-0.025	[-.109; -.059]	-0.58	.562	48.68	9	<.001	81.51	.015	.009
Multitasking SNS use and												
Academic achievement	15	7,615	-0.103	[-.161; -.045]	-3.46	.001	83.40	14	<.001	83.21	.010	.006
SNS use for academic purposes and												
Academic achievement	10	2,589	0.075	[.015; .135]	2.45	.014	19.37	9	.022	53.53	.005	.004
Learning time and												
Academic achievement	14	5,015	0.153	[.057; .246]	3.12	.002	146.14	13	< .001	91.10	.030	.015

Table 3.

Moderator Analyses for General SNS Use and Academic Achievement

Variable	***K***	**Between-groups analysis**	**Subgroup Effect Size**	**By Group Analysis**
Publication type		Q (1) = 1.642, *p* = .200		
Published	35		$\hat{\rho} = -.05$, 95% CI [-0.12, 0.02], *Z* = -1.45, *p* = .147	*Q* (34) = 680.12, *p* < .001
Unpublished	20		$\hat{\rho} = -.11$, 95% CI [-0.18, -0.04], *Z* = -3.21, *p* = .001	*Q* (19) = 112.35, *p* < .001
Developmental status		*Q* (2) = 0.641, *p* = .726		
Very high developed countries	36		$\hat{\rho} = -.08$, (95%CI = -0.14; -0.03, *Z* = -2.89, *p* = .004)	*Q* (35) = 396.45, *p* < .001
High developed countries	10		$\hat{\rho} = -.09$, (95%CI = -0.18; -0.01, *Z* = -2.08, *p* = .038)	*Q* (9) = 41.22, *p* < .001
Medium and low developed countries[a]	9		$\hat{\rho} = -.01$, (95%CI = -0.20; 0.19, *Z* = -0.06, *p* = .949)	*Q* (8) = 365.89, *p* < .001
Academic achievement measure		*Q* (1) = 7.226, *p* = .007		
Self-reported achievement	41		$\hat{\rho} = -.09$, (95%CI = -0.15; -0.03, *Z* = -2.72, *p* = .007)	*Q* (40) = 772.09, *p* < .001
Documented achievement	14		$\hat{\rho} = .01$, (95%CI = -0.02; 0.04, *Z* = 0.52, *p* = .604)	*Q* (13) = 9.24, *p* = .755
Type of effect size		*Q* (1) = 7.273, *p* = .007		
Correlation	41		$\hat{\rho} = -.11$, (95%CI = -0.17; -0.05, *Z* = -3.48, *p* = .001)	*Q* (40) = 538.73, *p* < .001
Regression weight	14		$\hat{\rho} = .03$, (95%CI = -0.05; 0.11, *Z* = 0.75, *p* = .453)	*Q* (13) = 170.05, *p* < .001

Sample type		*Q* (1) = 4.678 , *p* = .031		
Adolescents	11		$\hat{\rho} = .01$, (95%CI = -0.05; 0.06, *Z* = 0.232, *p* = .817)	*Q* (10) = 21.57, *p* = .017
Undergraduates[b]	44		$\hat{\rho} = -.08$, (95%CI = -0.14; -0.02, *Z* = -2.66, *p* = .008)	*Q* (43) = 744.73, *p* < .001

Notes. [a]*k* = 2 medium developed countries, *k* = 7 low developed countries; [b]Includes one sample consisting undergraduates and other adults

Table 4.

Moderator Analyses for Multitasking SNS use and Academic Achievement

Variable	***K***	**Between-groups analysis**	**Subgroup Effect Size**	**By Group Analysis**
Publication type		Q (1) = 0.006, *p* = .938		
Published	10		$\hat{\rho} = -.10$, (95%CI = -0.16; -0.05, *Z* = -3.57, *p* < .001)	*Q* (9) = 40.04, *p* < .001
Unpublished	5		$\hat{\rho} = -.09$, (95%CI = -0.27; 0.09, *Z* = -1.02, *p* = .306)	*Q* (4) = 39.46, *p* < .001
Region		*Q* (1) = 0.002, *p* = .963		
Very high developed countries	14		$\hat{\rho} = -.10$, (95%CI = -0.16; -0.04, *Z* = -3.30, *p* = .001)	*Q* (13) = 83.38, *p* < .001
High developed countries	1		$\hat{\rho} = -.10$, (95%CI = -0.24; 0.04, *Z* = -1.41, *p* = .159)	
Academic achievement measure		*Q* (1) = 0.957, *p* = .328		
Self-reported achievement	8		$\hat{\rho} = -.13$, (95%CI = -0.24; -0.02, *Z* = -2.23, *p* = .026)	*Q* (7) = 60.29, *p* < .001
Documented achievement	7		$\hat{\rho} = -.07$, (95%CI = -0.11; -0.03, *Z* = -3.29, *p* = .001)	*Q* (6) = 10.39, *p* = .109
Type of effect size		*Q* (1) = 0.033, *p* = .855		
Correlation	8		$\hat{\rho} = -.10$, (95%CI = -0.22; 0.02, *Z* = -1.68, *p* = .092)	*Q* (7) = 59.96 *p* < .001
Regression weight	7		$\hat{\rho} = -.09$, (95%CI = -0.14; -0.04, *Z* = -3.54, *p* < .001)	*Q* (6) = 16.86, *p* = .010

Sample type		Q (1) = 3.717 , p = .054		
Undergraduates	14		$\hat{\rho} = -.10$, (95%CI = -0.16; - 0.04, Z = -3.10, p = .002)	Q (13) = 78.23, p < .001
Mixed sample	1		$\hat{\rho} = -.23$, (95%CI = -0.34; -0.11, Z = -3.69, p < .001)	

Table 5.

Moderator Analyses for SNS use for Academic Purposes and Academic Achievement

Variable	***K***	**Between-groups analysis**	**Subgroup Effect Size**	**By Group Analysis**
Publication type		Q (1) = .687, p = .407		
Published	5		$\hat{\rho}$ = .10, (95%CI = - 0.00; 0.20, *Z* = 1.92, *p* = .055)	*Q* (4) = 16.40, *p* = .003
Unpublished	5		$\hat{\rho}$ = .05, (95%CI = -0.02; 0.12, *Z* = 1.37, *p* = .172)	*Q* (4) = 2.70, *p* = .609
Region		*Q* (1) = 0.021, *p* = .886		
Very high developed countries	7		$\hat{\rho}$ = .08, (95%CI =-0.00; 0.16, *Z* = 1.91, *p* = .056)	*Q* (6) = 17.63, *p* = .007
High developed countries	3		$\hat{\rho}$ = .07, (95%CI = -0.02; 0.15, *Z* = 1.61, *p* = .107)	*Q* (2) = 1.70, *p* = .428
Academic achievement measure		*Q* (1) = 1.202, *p* = .273		
Self-reported achievement	7		$\hat{\rho}$ = .06, (95%CI = -0.01; 0.14, *Z* = 1.62, *p* = .105)	*Q* (6) = 16.27, *p* = .012
Documented achievement	3		$\hat{\rho}$ = .13, (95%CI = 0.04; 0.21, *Z* = 2.82, *p* = .005)	*Q* (2) = 0.539, *p* = .764
Type of effect size		*Q* (1) = 1.229, *p* = .268		
Correlation	8		$\hat{\rho}$ = .09, (95%CI = 0.02; 0.16, *Z* = 2.37, *p* = .018)	*Q* (7) = 17,57 *p* = .014
Regression weight	2		$\hat{\rho}$ = .03, (95%CI = -0.06; 0.11, *Z* = 0.64, *p* = .526)	*Q* (1) = 0.96, *p* = .327

Sample type		Q (1) = 0.020 , p = .886		
Adolescents	2		$\hat{\rho}$ = .07, (95%CI = -0.08; 0.21, Z = 0.91, p = .363)	Q (1) = 2.12, p = .146
Undergraduates	8		$\hat{\rho}$ = .08, (95%CI = 0.01; 0.15, Z = 2.13, p = .033)	Q (7) = 16.49, p = .021

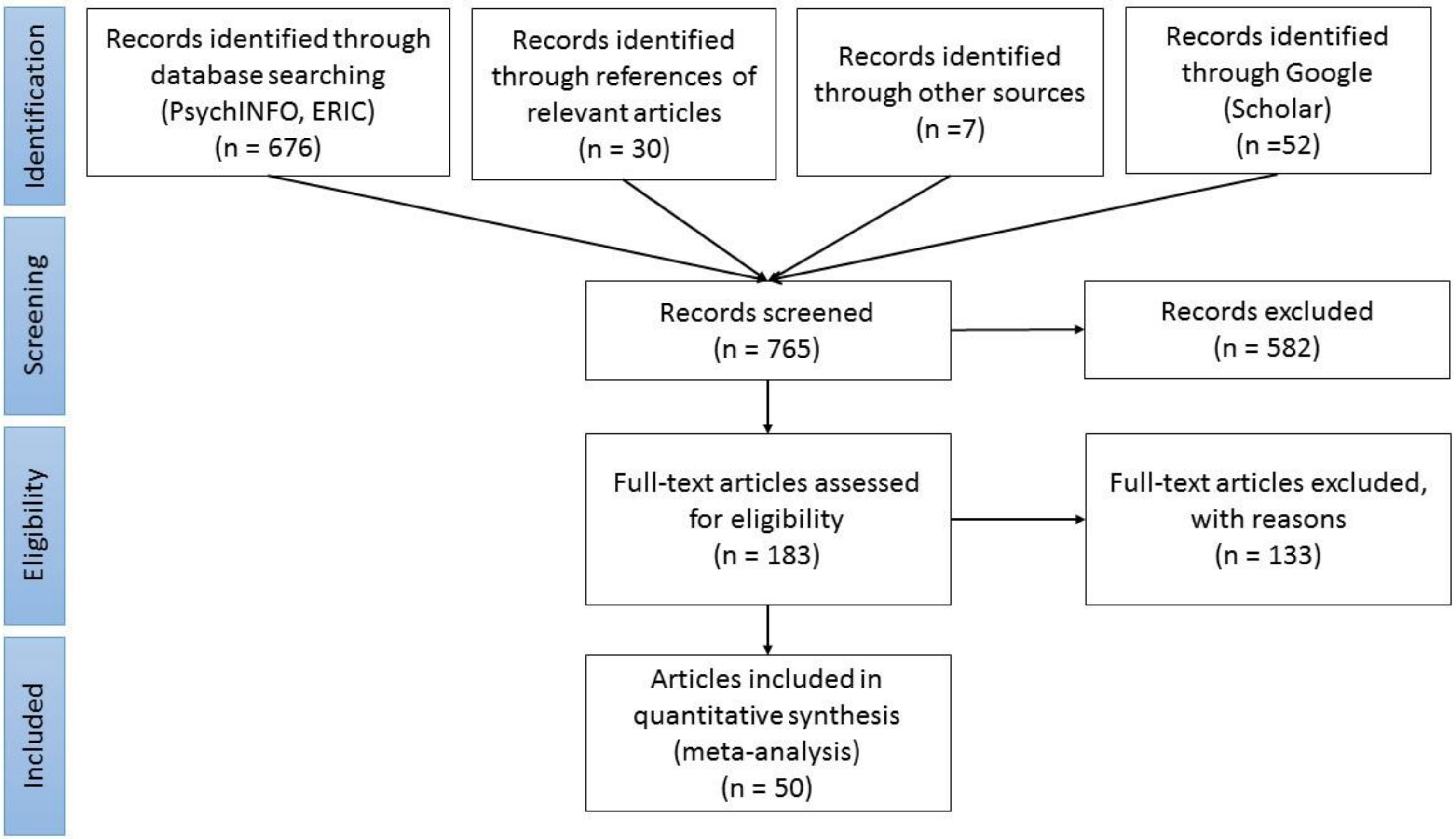

Figure 1. Flowchart of the literature search process.

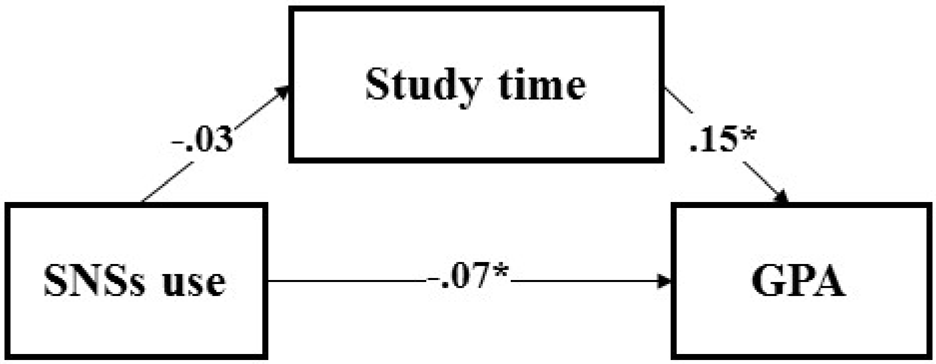

Figure 2. Meta-analytic test of the time displacement hypothesis. Standardized regression parameters (**p* < 05) are presented.

Supplementary Material

Table S1

Country, number of studies from the country included in the meta-analyses, HDI value, and HDI category.

Country	Number of Studies	HDI value (category)	Meta-analysis
China	1	0.719 (high developed)	General measures
Croatia	1	0.812 (very high developed)	General measures Multitasking Academic purposes
Ethiopia	1	0.435 (low developed)	General measures
EU	2	0.738 (very high developed)	General measures (2) Multitasking (2)
Ghana	1	0.573 (medium developed)	General measures
Hong Kong	2	0.719 (high developed)	General measures
Iran	1	0.749 (high developed)	General measures
Jordan	1	0.715 (high developed)	General measures
Kuwait	1	0.814 (very high developed)	General measures
Malaysia	2	0.773 (high developed)	General measures
New Zealand	2	0.910 (very high developed)	General measures
Nigeria	4	0.504 (low developed)	General measures
Pakistan	2	0.537 (low developed)	General measures
Philippines	1	0.660 (medium developed)	General measures
Sweden	1	0.898 (very high developed)	General measures
Taiwan	1	0.719 (high developed)	General measures Academic purposes
Thailand	2	0.722 (high developed)	General measures (2) Academic purposes (2)

Tunisia	1	0.721 (high developed)	General measures
Turkey	2	0.759 (high developed)	General measures (2) Multitasking (1) Academic purposes (1)
USA	30	0.910 (very high developed)	General measures (26) Multitasking (11) Academic purposes (5)

Notes: HDI categories based on the United Nations Development Programme (2016). Very high developed HDI ≥ 0.800, high developed HDI = 0.700-0.799, medium developed HDI = 0.550 – 0.699, low developed HDI ≤ 0.550.

United Nations Development Program (2014). *Human Development Index and its components.* Retrieved from http://hdr.undp.org/en/composite/HDI.

Supplementary Material: Funnel Plots

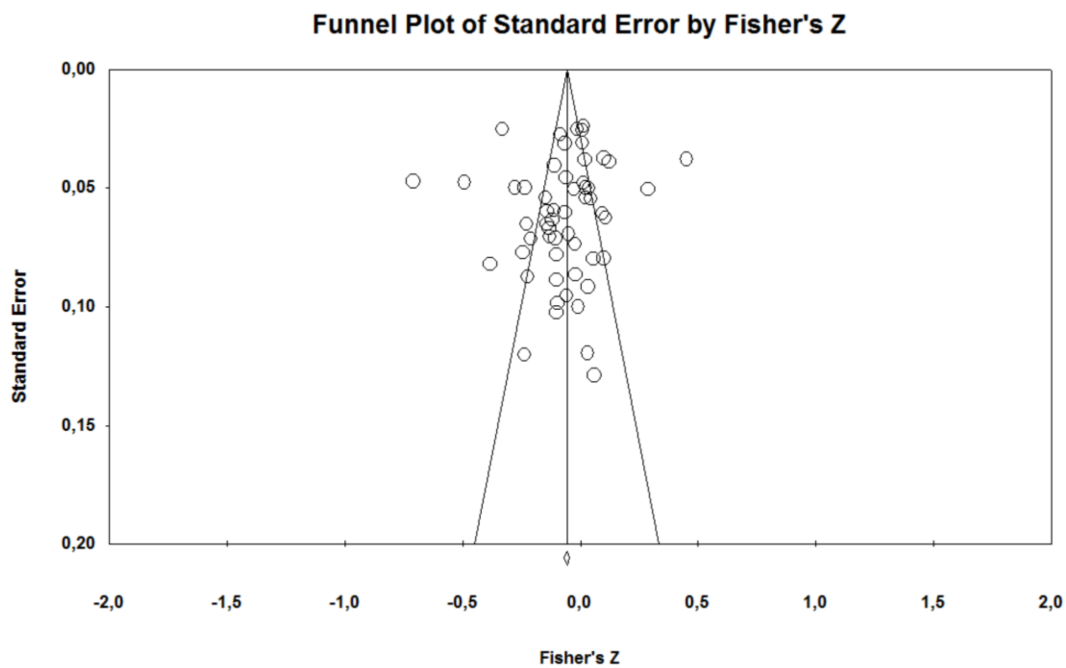

Figure S1. Funnel plot pertaining to the general SNS use meta-analysis

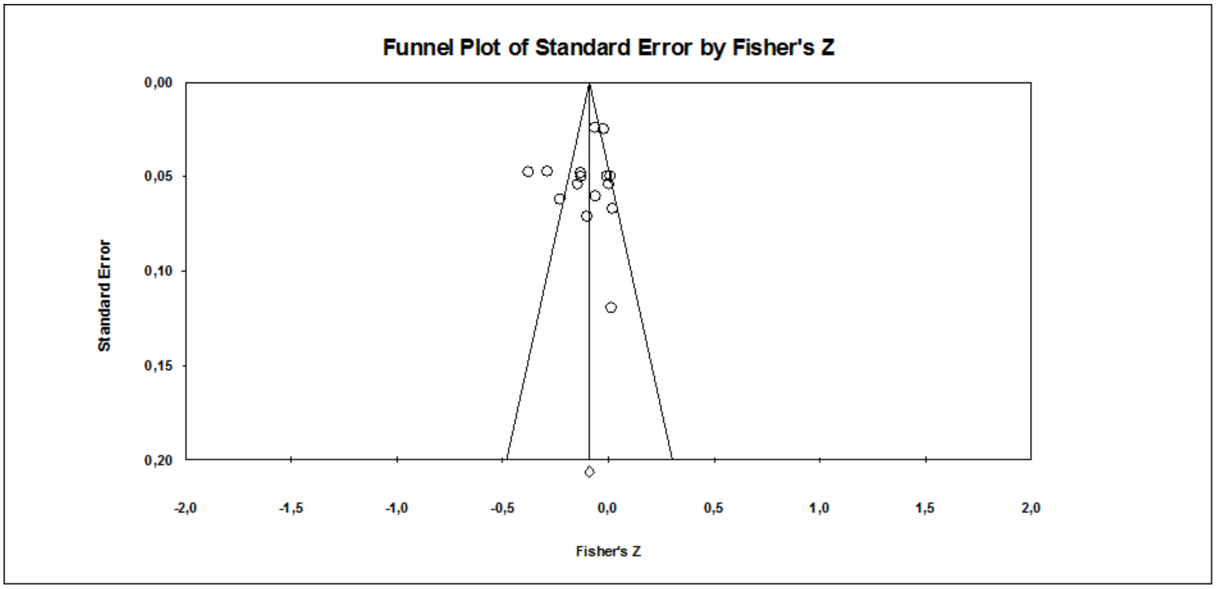

Figure S2. Funnel plot pertaining to the multitasking SNS use meta-analysis

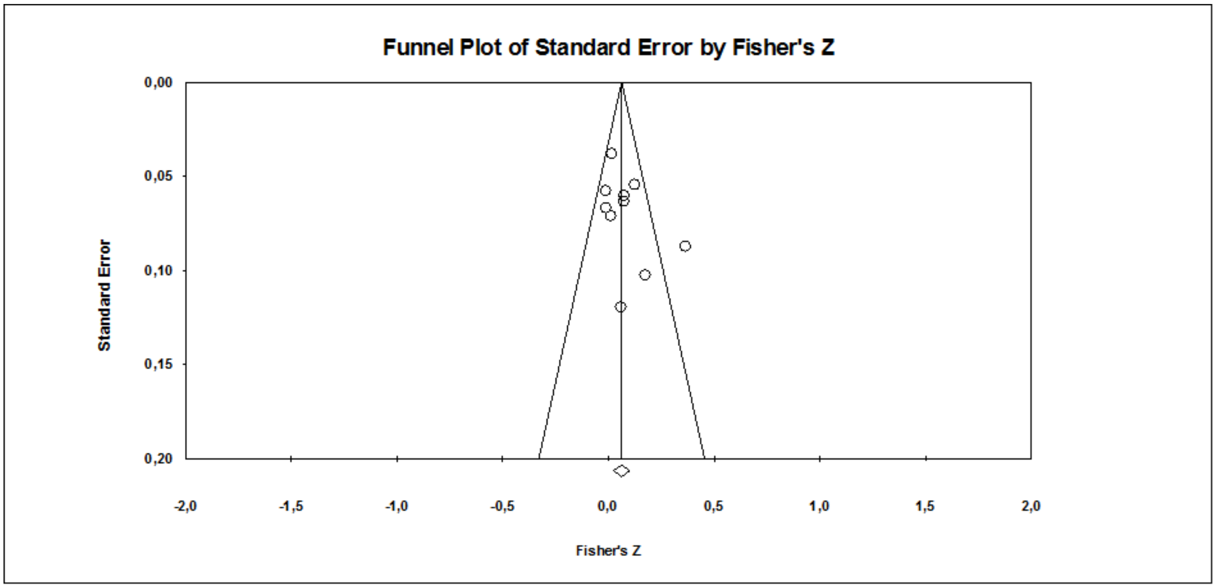

Figure S3. Funnel plot pertaining to the SNS use for academic purposes meta-analysis