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A meta-analysis of the relationship of academic performance and Social Network Site use among adolescents and young adults

Dong Liu [a, *], Paul A. Kirschner [b, d, 1], Aryn C. Karpinski [c, 1]

[a] The Center of Internet Plus Social Psychology, Department of Psychology, Renmin University of China, 100872, Beijing, China
[b] Department of Psychology and Educational Sciences, Welten Institute, Research Centre for Learning, Teaching, and Technology, Open University of the Netherlands, The Netherlands
[c] School of Foundations, Leadership and Administration, Evaluation and Measurement, Kent State University, USA
[d] University of Oulu, Finland

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ABSTRACT

This meta-analysis explores the relationship between SNS-use and academic performance. Examination of the literature containing quantitative measurements of both SNS-use and academic performance produced a sample of 28 effects sizes ($N = 101{,}441$) for review. Results indicated a significant negative relationship between SNS-use and academic performance. Further moderation analysis points to test type as an important source of variability in the relationship. We found a negative correlation between SNS-use and GPA, while a positive one for SNS-use and language test. Moreover, we found that the relationship of SNS-use and GPA was more strongly negative in females and college students.

1. Introduction

The relationship between academic performance and the use/visiting of a Social Network Site (SNS) has been the focus of a fair amount of research attention in the past decade. As this literature base has grown, questions have emerged about important theoretical and practical issues: Is SNSs use beneficial or harmful to academic performance? Can the relationship between academic performance and SNSs use be moderated by educational levels (e.g., middle school & college) and academic test types (e.g., literacy & achievement)? Are there gender differences in the relationship between SNS-use and academic performance? Given these questions, the time is ripe for a systematic review and analysis of the research on SNS-use and academic performance.

2. SNS-use and academic performance

2.1. Social networks and Social Network Site

Social Network Site is unique in its definition (Ellison & Boyd, 2013). It is a networked communication platform in which participants 1) have uniquely identifiable profiles that consist of user-supplied content, content provided by other users, and/or system-level data; 2) can publicly articulate connections that can be viewed and traversed by others; and 3) can consume, produce, and/or interact with streams of user-generated content provided by their connections on the site. These three key elements articulate the scope and emphasis of SNS, differentiating it from networking and relationship initiation between strangers. On many of the large SNS, participants are primarily communicating with people who are already a part of their extended social network.

2.2. SNS and academic performance

Scholars believe that SNS may impact informal learning processes and academic performance. Some believe that SNS like Facebook can be harnessed to facilitate learning processes, such as knowledge sharing, knowledge construction, and argumentation

* Corresponding author.
E-mail addresses: bnuliudong@gmail.com (D. Liu), paul.kirschner@ou.nl (P.A. Kirschner), akarpins@kent.edu (A.C. Karpinski).
[1] Professor Paul A. Kirschner and Dr. Aryn C. Karpinski are co-first authors of this paper and make equal contributions.

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learning (Greenhow, Gibbins, Menzer, 2015; Tsovaltzi, Judele, Puhl, & Weinberger, 2015). In their study, Junco, Heiberger and Loken (2011) found that Twitter® can be used as an educational tool to help engage students and to mobilize faculty into a more active and participatory role. SNS (e.g., Facebook®, Twitter) may "facilitate informal communication around classroom activities" (Lampe, Wohn, Vitak, Ellison, & Wasch, 2011, p.331). That is, students may use Facebook® for educational goals, such as sharing information about their classroom activities, collaborating with their peers on assignments, and arranging study groups (Lampe et al., 2011). However, it should be noted that the primary use of SNS is still for communication, and not for schoolwork. SNS is still predominantly a social tool unrelated to school. In real life, students do not have much knowledge of using SNS for learning and problem solving, and they rarely use SNS for learning purposes (Kirschner, 2015). While many scholars and educators espouse the point that SNSs may positively impact academic performance, there is little empirical evidence that Facebook and other SNS-use actually facilitate learning and improve academic performance.

On the contrary, ample evidences supported that SNS-use may impair academic performance in important ways. One way is that learners studying while making simultaneous use of SNS 'multi-task'? Multitasking is the simultaneous execution of two or more information processing activities (i.e., cognitive processes) at the same time. Multitasking on an SNS is widely considered to be a major source of attention distraction from learning that impairs students' overall semester GPAs (e.g., Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013; Kirschner & Karpinski, 2010; Judd, 2014; Junco, 2012a; Junco & Cotten, 2012). Kirschner and Karpinski (2010) found that the use of SNS was associated with a lower GPA and especially when disruptive multitasking was reported. Judd (2014) demonstrated that Facebook was one of the most common computer-based activities among Australian students and its use included significantly more multitasking behaviors and less focused behaviors. Junco (2012) found that SNSs activities such as status updates or chatting that require considerable cognitive resources may lead to cognitive overload and multitasking errors. A summary of the findings on the relationship between SNS-use, multitasking and academic performance was reported in Table 1.

Displacement effect of both attention and time may also negatively impact academic performance. Recent studies found that increased dependence on SNS was also correlated with decreased sleep quality and with increased everyday cognitive failures (Orzech, Grandner, Roane, & Carskadon, 2016; Xanidis & Brignell, 2016). Students who reported spending more hours on SNS before bedtime are, hence, expected to have more schoolwork problems than those who did not as they are always in a state of cognitive fatigue on class or learning. Also, excessive SNS-use may take time away from important academic responsibilities such as studying and exercising.

However, there is no consensus that SNS-use is negatively associated with lower GPA (Kirschner & Karpinski, 2010; Junco, 2012b, 2015; Pasek & Hargittai, 2009). Early in 2009, Karpinski and Duberstein reported a negative relationship between SNSs use and academic achievement as measured by self-reported GPA and hours spent studying per week. However, some following studies found non-significant (Kolek & Saunders, 2008; Pasek & Hargittai, 2009) or positive results. A meta-analysis and systematic review is in need to clarify this inconsistency.

2.3. Academic test types

Academic test was different by test content and aims. After a systematic review, we found that the variation on academic test types was an important contributor to the differences of effect between SNS-use and academic performance. Achievement and literacy test are the two types of test we found in this area of research, which are very different. Although excessive SNS-use was pervasively thought to be linked to poorer GPA, Alloway and his associates (2013) surprisingly found that students who had used Facebook for over one year had significantly higher scores in working memory, verbal ability, and spelling compared to those who had used Facebook for less than a year. They articulated that Facebook use is just like a working memory task that trained students' information processing ability. Longer use with SNS like Facebook might provide the students with 'training' that could boost cognitive skills to impact literacy test performance including verbal and spelling scores (Alloway, Horton, Alloway, & Dawson,

Table 1
Summary of main findings on the relationship between SNS(s) Use, multitasking and Academic performance.

Author(s), Year	Participants/Country	*N*	Purpose	Finding
Ellis, Daniels, & Jauregui, (2010)	Undergraduate business students, Southeastern, US.	62	To empirically examine whether multitasking in class affects the grade performance of business students.	Multitasking during class is considered a distraction that is likely to result in lower grade performance.
Gabre & Kumar (2012)	Historically Black College (HBCU), and a metropolitan university, US	95	To investigate the effect of Facebook® usage on accounting students' academic performance.	Accounting students who use Facebook® while studying experienced lower academic performance after controlling for stress.
Golub & Miloloža (2010)	Undergraduate students, Croatia.	277	To compare Facebook® users and nonusers on self-esteem and academic achievement variables and to investigate the factors related to perceived positive and/or negative impact of Facebook® on academic performance.	The results showed that active multitasking made a significant contribution, independent of intensity of Facebook® use, to the prediction of negative Facebook® impact on academic performance.
Junco and Cotten (2012)	4-year, public, primarily residential institution, Northeastern US.	1839	To examine how college students multitask with ICTs and to determine the impacts of this multitasking on their college grade point average (GPA).	Using Facebook® and texting while doing school work were negatively associated with overall college GPA. Engaging in Facebook® use or texting while trying to complete school work may tax students' capacity for cognitive processing and preclude deeper learning.
Karpinski et al., (2013)	Undergraduate and graduate students, US vs. Europe	875	To investigate multitasking's impact on the relationship between SNS use and Grade Point Average (GPA) in United States and European university students using quantitative and qualitative data analysis.	Moderated Multiple Regression analysis results showed that the negative relationship between SNS use and GPA was moderated by multitasking only in the US sample.

2013). But it might just as easily be the case that because of the availability of Facebook, students who previously had not actively constructed any texts in the past (i.e., the typical teenager) now are writing Facebook posts and thus are actively engaged in text production and that they are reaping the benefits of this.

2.4. Educational levels

Previous research shows that younger college students have difficulty effectively regulating their Facebook use to balance academic and social demands (Junco, 2015). When transitioning to college, college freshmen usually face a series of challenges from social adaptation to academic difficulty. They are highly likely to multitask with SNSs on class or during academic work for social adaption purposes. As we mentioned before, these SNS use patterns are negatively related to grades. Therefore, we expect to see a stronger negative effect between SNS-use and GPA among college students.

2.5. Gender differences

Gender differences have been widely documented in the SNS literature. Research has shown that females spend more time on SNS (Christofides, Muise, & Desmarais, 2009), disclose more information (Liu & Brown, 2014), and send more SNS messages. Conversely, males are more likely to use video games as conduits for conversations with friends (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). These patterns of gender differences in SNS-use indicate that females may be more likely to use SNS to multi-task while studying (i.e., being more frequent SNS users than males), and thus are using them more during the learning process. This could lead to a greater negative effect of SNS-use on academic performance in females.

2.6. Causal directions

One question that is of great interest is whether SNS-use leads to changes in academic performance or vice versa. For example, Pasek and Hargittai (2009) examined this causal direction issue with longitudinal data. They found a negative correlation between 2008 Facebook use and change in grade point average from 2007 to 2008 with the NASY Panel data, suggesting that students with poorer academic performance tend to spend more time on SNS. A meta-analysis of the longitudinal data and comparing its aggregated effects with cross-sectional data may help us distinguish the causal direction of the effects.

2.7. Current study

Most research on the use of SNSs and academic performance is limited to a specific test type, or a particular educational stage. This meta-analysis quantitatively examines the relationship between using SNS (i.e., how often/how much) and academic performance by comparing the effect sizes with different educational levels, test types or gender differences. Specifically, we anticipate that this meta-analysis would address the following research aims:

1. Provide an overview of the relationship between SNS-use and academic performance and quantify the overall effect of this relationship.
2. Determine how the moderator variables influence the effects of SNS-use on academic performance.
3. Synthesize the disadvantages of the current literature in levels of moderator variables based on the content analysis of articles related with moderator variables.

3. Method

3.1. Literature search

Four methods were used to search for relevant studies. First, we retrieved articles through a detailed search of PsycINFO, PsycArticles, EBSCO—ERIC, Medline, Communication and Mass Media Complete (CMMC), Google Scholar, and ProQuest Dissertations & Theses. The following key words were used: *academic adjustment, academic performance, GPA, grades, Facebook, Myspace, Twitter, Social Network Sites, social media*. Second, we conducted systematic searches using Chinese, Japanese and French translation of the key words in Google Scholar, CNKI and CiNii. Third, we searched the in-press or online-first articles. Finally, we searched the conference database: International Communication Association Conference (ACM), International Conference on Web and Social Media (ICWSM), Annual SIGCHI Conference, ACM digital library. We contacted authors of relevant posters or presentations at these conferences to ask for information about their studies. We did not place any limitations on age, geography, SNS types, or other sample characteristics in our search. The literature search encompassed articles published up to March 1, 2016.

3.2. Inclusion and exclusion criteria

Our search resulted in 1254 records for screening to identify eligible studies. After examining the titles and abstracts of all the references and discarding irrelevant ones, thirty articles were identified as relevant. The thirty articles were included in or excluded from our meta-analysis based on the following criteria: (a) the studies needed to be empirical and quantitative (i.e., review, theoretical, and qualitative studies were excluded); (b) global measures of SNSs usage (e.g., intensity, duration, or visiting frequency) or specific measure of SNS activities were provided; (c) academic performance was measured by semester or cumulative GPA, or a test; (d) Pearson correlation coefficients were provided; otherwise, sufficient information from which an effect size could be derived needed to be available; (e) studies examining SNS addiction were excluded; (f) studies violating the assumption of independent samples were excluded.

If a study used the same data as any previously coded studies, it was considered a violation of independent samples. In cases where the results of a specific data set were re-used or otherwise duplicated in more than one publication, we chose the publication that contained the most information or was published in the journal with the highest impact factor. In the end, 24 studies yielding 28 effect sizes met the criteria for inclusion, see Fig. 1.

3.3. Coding

Studies that met the inclusion criteria were coded for sample characteristics (i.e., proportion of female participants, average age, sample size and SNS measures). Here, we operationalize “SNS-use" as “global time to use SNS”, “frequency of SNS-use”, or “SNS-use intensity measured by the scale developed by Ellison, Steinfield, and Lampe (2007). The first author developed a coding manual that specified the coding categories and possible codes to be used for each study. Following the coding manual, the first author and a doctoral student coded all information contained in the 28 studies. Agreement was reached in 95% of the two coders’ coding. All disagreements were resolved through discussion between the coders.

3.4. Computation of effect sizes

First, correlation coefficients (r) for the relationships between

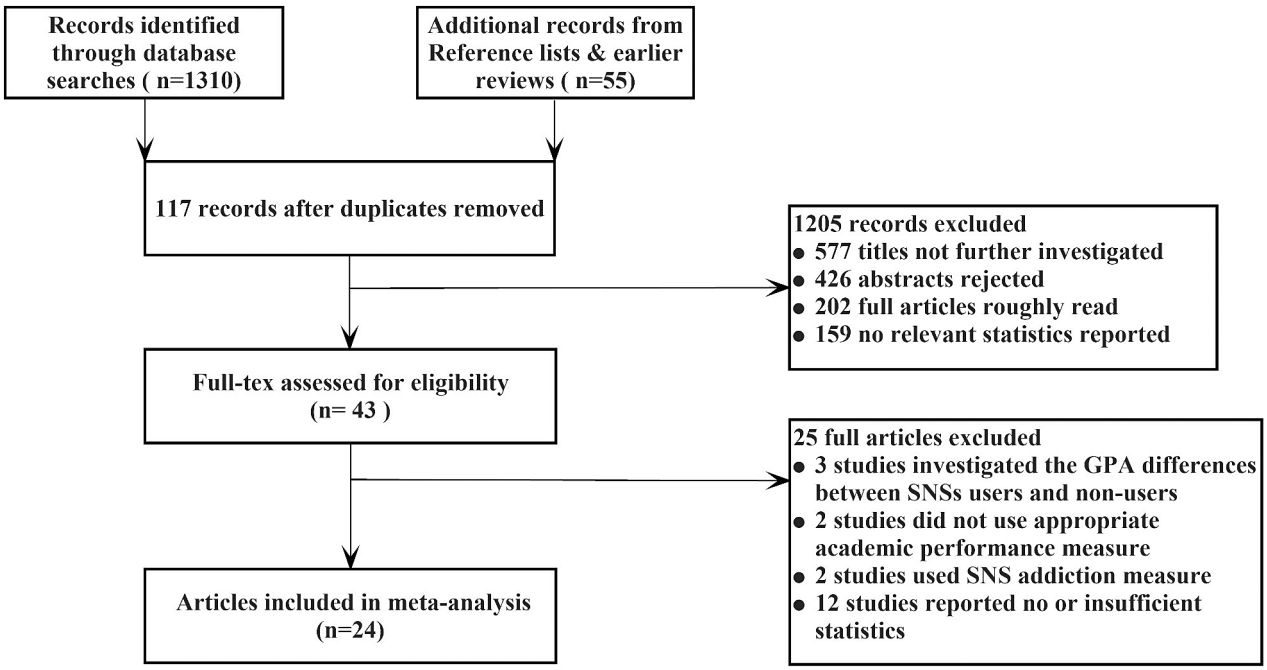

Fig. 1. Flowchart for the included studies in systematic review and meta-analysis.

SNSs usage and academic performance were recorded. Then, we used the meta-analytic procedures of Schmidt and Hunter (2014) to correct observed correlations for measurement error in both predictor and criterion scores. Correlations were corrected individually with internal reliability. A large majority of studies reported the reliability needed for the correction. For the few cases in which reliability was not provided, we used the average value across other studies to complete the correction. Finally, the meta-analyses were conducted using effect sizes that were transformed to Fisher's *Z*, using study weights with $\omega = n - 3$ (Lipsey & Wilson, 2001). Effect sizes were then transformed back into correlations when reporting the results of the analyses for ease of interpretation. Based on existing literature, we expected that the true effect sizes would differ across channels. Random-effects models were used for all five channels. All analyses were completed in Comprehensive Meta-Analysis version 3 (Borenstein, Hedges, Higgins, & Rothstein, 2014).

3.5. Publication bias analysis

Following the standard practice for testing publication bias in meta-analysis, we applied trim and fill method to check possible bias. We also visually check the funnel plots of effect size. Finally, we applied the p-curve technique to examine the publication bias.

4. Results

4.1. Sample description

The data set included 28 independent effect sizes between SNS-use and academic performance from 101,847 participants. From these, 23 came from college/university and 5 were sampled in high and middle school. The female proportion of the sample ranged from 0 (i.e., no females in the sample; 0%) to 1 (i.e., all female sample; 100%). The sample sizes ranged from 35 to 87,735 participants.

4.2. Effect sizes of the academic performance

The *Q* statistics were significant in our sample and I^2 (94.03%) were over 75%, suggesting that the high levels of heterogeneity were due to real differences among the selected samples as opposed to sampling error (Higgins, Thompson, Deeks, & Altman, 2003). This warranted the use of a random effects model (see Table 2). For the 28 independent samples between SNSs use and academic performance, the average effect size was −.08 for the random-effects with the 95% Confidence Interval (C. I.) from −.13 to .02; According to Cohen (1992), this was a small effect size. Please see Fig. 2 for further information.

4.3. Moderation analyses

In addition to the overall effect-size analysis, moderation effects in the SNS and academic performance literature were also examined. In the analysis, we examined whether there are systematic

Table 2
Subgroup analyses of the effect sizes.

	k	*N*	*ρ*	95% *CI*	*τ*	I^2 (%)	$Q_{between}$
Stage							
College	23	12,973	−.09	[−.16, −.01]	.17	93.62%	2.39
Middle & High	5	88, 874	.01	[−.09, .12]	.09	81.73%	
Test type							
Literacy	2	87,839	.05	[.00,.10]	.17	11.96%	9.88**
Achievement	26	14,008	−.09	[−.16. −02]	.03	93.21%	
Design							
Cross-sectional	27	101,544	−.07	[−.13, −.02]	.08	94.12%	.23
Longitudinal	1	303	−.15	[−.26, −.04]	0	0	
Measure							
SNS frequency	3	524	−.01	[−.19, .17]	.14	73.30%	0.66
SNS intensity	2	1237	−.06	[−.35, .25]	.21	84.68%	
SNS time	18	94, 221	−.09	[−.15, −.03]	.11	90.39%	

Note. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Study name	Correlation	Lower limit	Upper limit	Z-Value	p-Value
LaRose	-0.193	-0.290	-0.092	-3.714	0.000
Lee, Y. H.	0.045	0.038	0.052	13.338	0.000
Ainin	0.079	0.022	0.136	2.699	0.007
	-0.119	-0.223	-0.013	-2.195	0.028
Karpınski1	-0.270	-0.358	-0.177	-5.558	0.000
Lubis	0.152	-0.073	0.362	1.327	0.185
Glass	-0.154	-0.272	-0.032	-2.464	0.014
Al-Menayes	-0.264	-0.365	-0.157	-4.722	0.000
Kalpidou1	-0.040	-0.368	0.297	-0.226	0.821
Kalpidou2	0.070	-0.270	0.394	0.397	0.692
Kabre	0.086	-0.050	0.219	1.237	0.216
Junco	-0.038	-0.084	0.008	-1.629	0.103
Lee R.	0.080	0.048	0.112	4.827	0.000
Pasek3	-0.148	-0.256	-0.036	-2.582	0.010
Skiera	0.014	-0.168	0.195	0.149	0.881
Alloway	0.150	-0.044	0.333	1.519	0.129
Moon	-0.129	-0.262	0.009	-1.830	0.067
Michikyan	-0.170	-0.286	-0.050	-2.757	0.006
Jacobsen	-0.099	-0.159	-0.038	-3.180	0.001
Haddad	0.030	-0.242	0.298	0.212	0.832
Pasek1	0.010	-0.051	0.070	0.323	0.746
Pasek2	0.122	0.046	0.196	3.143	0.002
Ogedebe	0.033	-0.146	0.210	0.360	0.719
Alexander	-0.233	-0.441	-0.001	-1.972	0.049
Kashif	-0.114	-0.217	-0.008	-2.114	0.034
Brubaker	0.030	-0.201	0.258	0.251	0.802
Hyatt	-0.060	-0.139	0.019	-1.484	0.138
Karpinski2	-0.610	-0.665	-0.549	-15.005	0.000
	-0.075	-0.129	-0.021	-2.727	0.006

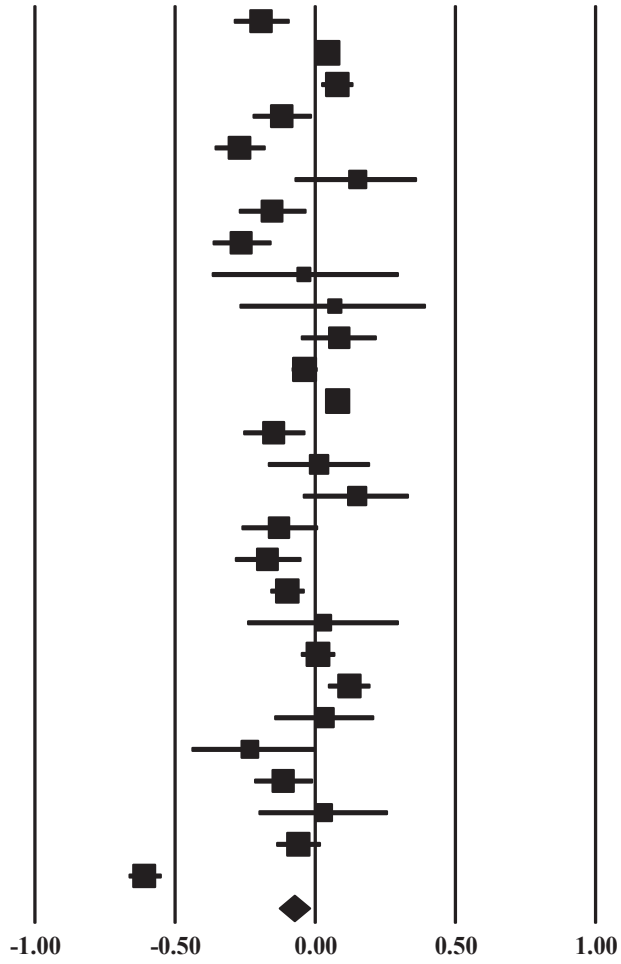

Fig. 2. Meta-analysis of Social Network Site use and academic performance.

differences in effects sizes between (1) different age groups (e.g., college students, middle and high school students), (2) different test types (e.g., achievement test, literacy test, and intelligence test), (3) study design (e.g., longitudinal and cross-sectional), and (4) female proportions (i.e., female-dominant, balanced or less female, and male-dominant). Specifically, we conducted a Mixed-Effects Model (MEM) for a moderator variable analysis.

Educational levels as a moderator. Table 2 indicated that young adolescents had a non-significant effect size of SNS and academic performance ($r = .01$, $CI = -.09$ to $.12$, $p > .05$), while college students ($r = -.09$, 95% $CI = -.16$ to $-.01$, $p < .05$) had negative effect sizes. These two effect sizes did have marginally significant difference ($Q = 2.33$, $p = .06$) in the hypothesized directions.

Test types as a moderator. Compared to achievement test, the effect sizes of SNS on literacy test were positive ($r = .05$, 95% $C.I. = .04–.05$). However, the average effect size between SNS-use and achievement test (GPA) was negative ($r = -.09$, $CI = -.16$ to $-.02$, $p < .001$).

Gender as a moderator. Female proportions in the samples were used as a continuous moderator. The analysis showed that the correlations between SNS-use and academic performance was more negative among females ($B = -.85$, $R^2 = .31$, $p < .001$, $k = 26$), see Fig. 3. Moreover, a secondary analysis only examining the college samples were conducted. The correlation became non-significant ($B = -.76$, $R^2 = .28$, $p < .05$, $k = 22$).

Longitudinal design as a moderator. Only one study included in the analysis was longitudinal in design. Subgroup analyses were performed based on the study's design, testing whether this factor influenced outcomes. Testing results demonstrated that longitudinal design effect size was more negative ($r = -.15$, $C.I. = -.26$ to $-.04$, $p < .01$), suggesting that there may be an obvious selection effect, namely, students with poorer academic performance will use SNS more.

4.4. Publication bias analysis

The funnel plot was symmetrical. Duval and Tweedie's (2000) trim and fill procedure also showed no bias. (see Fig. 4).

P-curve analysis was conducted (Simonsohn, Nelson, & Simmons, 2014) to confirm that the above finding was not a result of publication bias. Fig. 5 showed a shape that is right skewed and not flatter than 33%, suggesting that the data for meta-analysis of general SNS use and GPA has evidential value and that p-hacking is unlikely to have occurred (see Fig. 5).

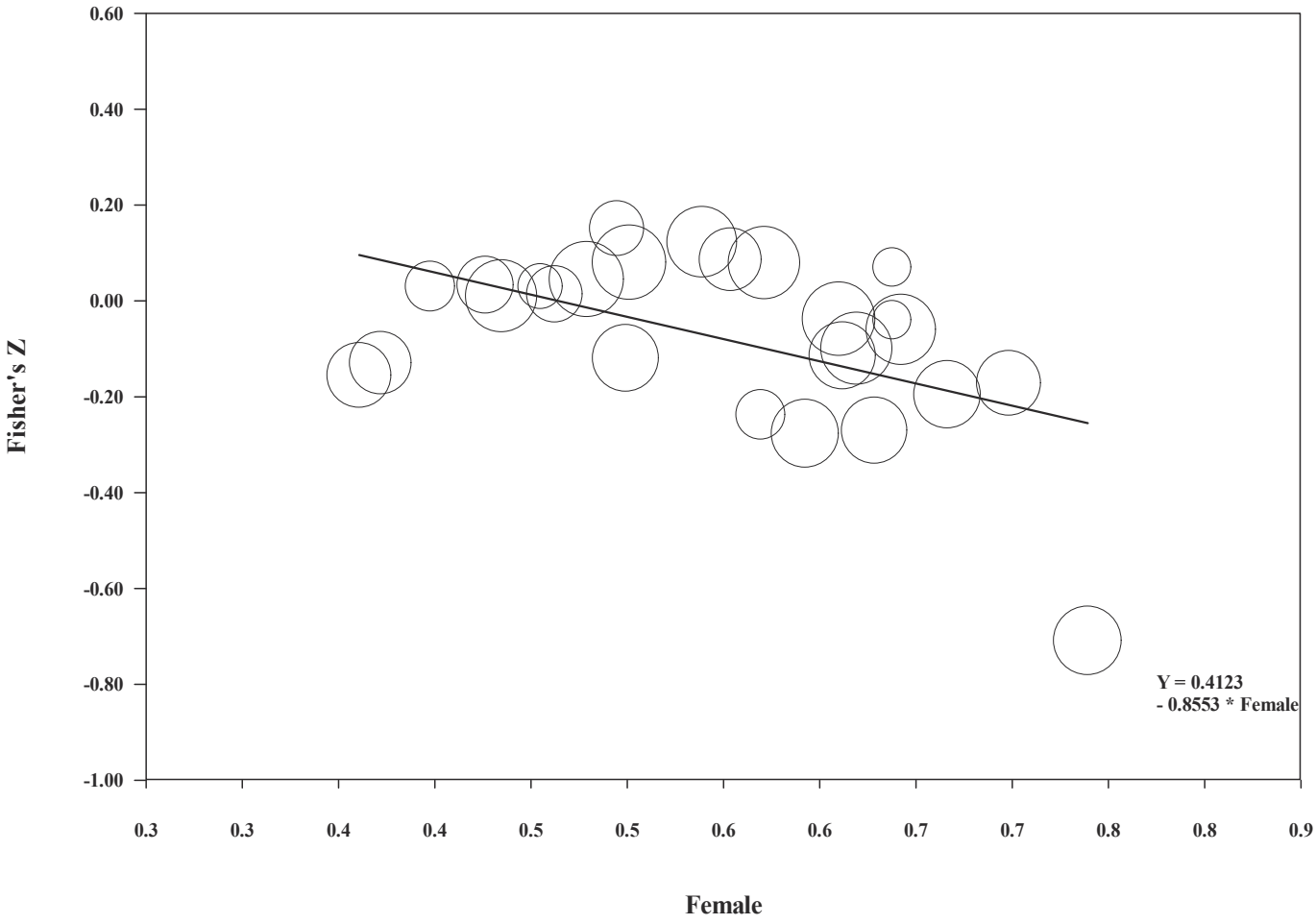

Fig. 3. Regression analyses of the effect sizes on female proportion.

4.5. Summaries of the relationship between specific SNS activities and academic performance

The SNS use is multi-purpose. People use SNS to achieve a variety of purposes, such as communication, building social networks, sharing information, studying, etc. The effects of SNS activities may be different. To explicate the differences, we summarized the recent related findings in Table 3. Educational and informational use of SNS was found to positively correlate with GPA, while socialization use of SNS was negatively associated with academic performance. However, most students spend significant time on Facebook more for social uses. Facebook is most of the time used as a social technology rather than a formal teaching tool (Hew, 2011; Madge, Meek, Wellens, & Hooley, 2009; Selwyn, 2009), which explains why the global effect of SNS use on academic performance is negative.

5. Discussion

The overall question addressed in this meta-analysis concerned the relationship between the use of SNSs and academic outcomes. As noted in the Introduction, previous findings were not consistent. Through this meta-analysis, a small negative effect size of SNS-use and academic performance was confirmed. One plausible reason to explain this negative effect may be task switching. Task switching involves moving from one task to another while carrying them out (see Fig. 6). As can be seen in Fig. 6, when switching between tasks there is a concomitant penalty both in processing time and accuracy. The premise behind the impairment is that the switcher is that human information processing is insufficient for attending to multiple stimuli and for performing simultaneous tasks (Chun, Golomb, & Turk-Browne, 2011; Wood et al., 2012) which leads to an increase in time to carry out the tasks accurately and a loss of accuracy/an increase in mistakes.

However, it is still difficult to discern the direction of the effects from the findings, even if a subgroup test of longitudinal and cross-sectional data were conducted. Only one set of longitudinal data was included in the subgroup analysis (Pasek & Hargittai, 2009), which suggested that students of poor academic performance were more likely to spend more time on SNS. No longitudinal data were found to investigate the impact of SNS-use on academic performance. With such small longitudinal samples, no causal inference can be made and the selection effect (students with poorer academic performance will use SNS more) was questionable. Here, we speculated that both the negative impact of SNS on academic performance and the selection effect of students with poor GPA to use SNS are true.

A high degree of heterogeneity was found for the effect of SNS-use and academic performance (see Table 2), which is warranted for moderation analysis. We identified test types as an important source of variation and found a significant effect. While GPA (i.e., achievement test) scores were negatively associated with SNS-use,

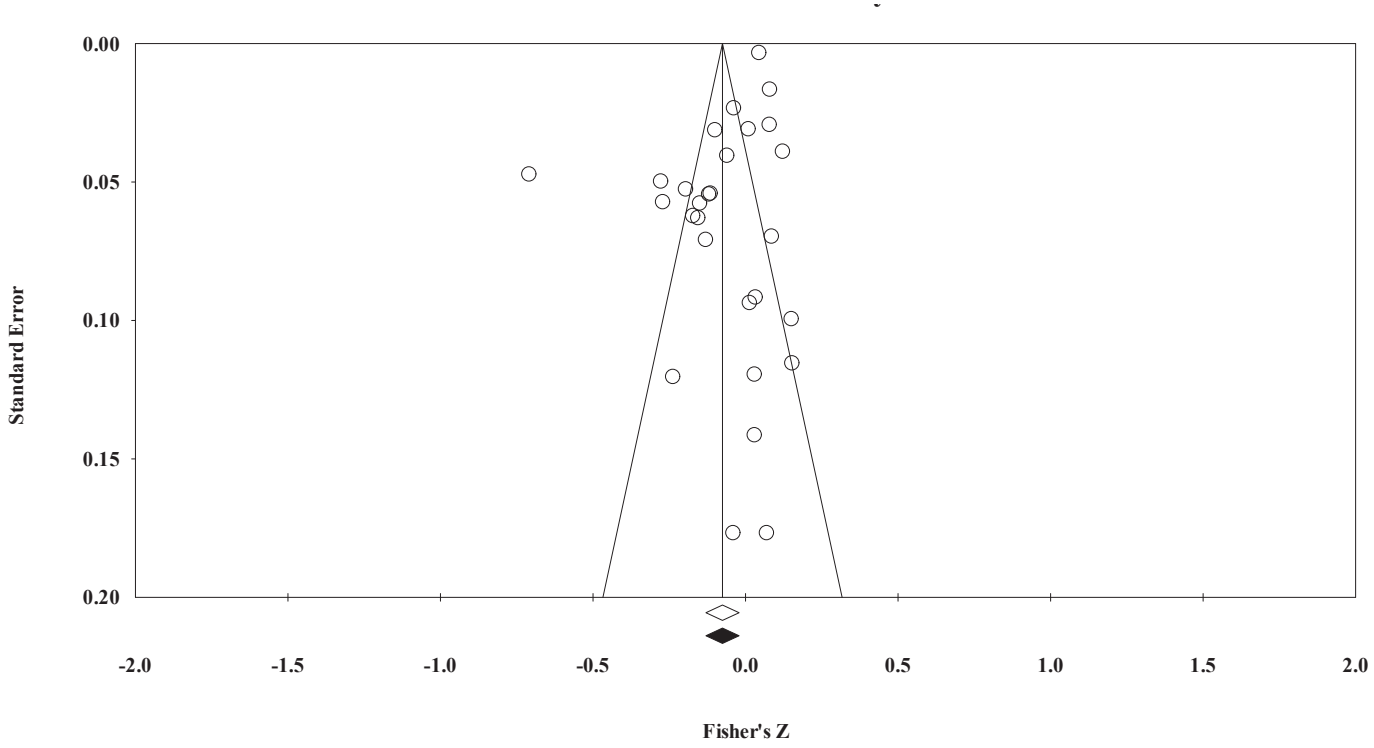

Fig. 4. Funnel plot for publication bias.

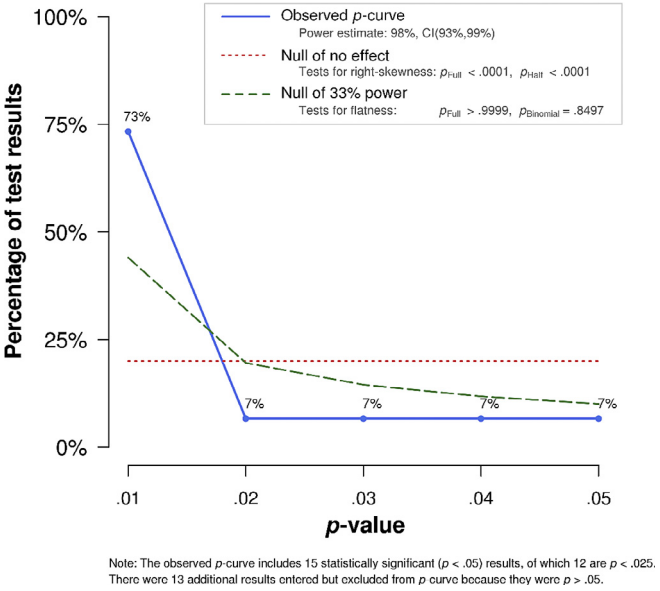

Fig. 5. P-curves for meta-analyses of Social Network Site use and GPA.

literacy test grades were positively associated with SNS-use. This is a key contribution for studies of new media use and academic learning: SNS-use was not always linked to poorer academic performance. In using SNS, it could be the case that students who in the past either did not or just minimally produced and or consumed texts (e.g., writing letters and/or essays, reading books and/or newspapers) are now both producing and consuming texts in their posts on SNS with concomitant increases in literacy (Greenhow, 2011; Steinkuehler, 2008). Further, with the pervasiveness of smartphones in our lives, reading messages and searching information from SNSs is becoming an increasingly often carried out digital experience. When people use an SNS, they frequently engage in information seeking and reading activities, which may be favorable for reading comprehension abilities (Bowman, Levine, Waite, & Gendron, 2010; Fox, Rosen, & Crawford, 2009; Lee & Wu, 2013). When communicating this with others they may be engaging in writing activities beneficial to their overall literacy.

This meta-analysis also sheds light on the effect of SNS-use on academic performance for students at different educational stages. We found that college students might be more vulnerable to the negative effects of SNS-use. College students, as compared to high school and middle school students study in a less structured environment. They can choose if and when to attend classes, if and when to study, there is an absence of direct parental supervision, and so forth. This means that a greater appeal has to be made on their ability to self-regulate their study and their study habits. Unfortunately, adolescents and young adults often lack this ability (Gestsdottir & Lerner, 2008) and/or their brains (i.e., their prefrontal cortices) are not sufficiently developed (Keating, 2004) impeding self-regulation of their study. Ophir, Nass, and Wagner (2009) show that heavy multitasking seems to go hand in hand with concentration difficulties; that is, self-proclaimed heavy multitaskers seem to be losing the ability to disregard irrelevant stimuli. Hence, these electronic multitasking activities in class or while studying are known to lower GPA (Jacobsen & Forste, 2011; Junco & Cotten, 2012; Wood et al., 2012).

Finally, although we hypothesized that females usually spend more time on SNSs (Christofides et al., 2009) and are even more addicted to SNSs than males (Steggink, 2015), there was no direct evidence that females are more likely to multitask with SNSs in

Table 3
Summary of main findings on the relationship between specific SNS(s) Activities And Academic performance.

Author(s)	Participants/Country	N	Sample description	Findings
Karpinski et al. (2016)	U.S., European college and graduate students	394; 446	Age M = 22.29, SD = 3.18; M = 25.52, S.D. = 7.07	SNSs for "career" and "school" were positively correlated with Grade Point Average (GPA) for both US and European students. For US students, "staying in touch with online friends" was negatively correlated with GPA.
Junco et al. (2012)	US college students	3866	Age M = 22.29, SD = 3.18;	Sharing links and checking to see what friends doing were positively related to GPA, while posting status updates and chatting on Facebook were negatively related to GPA.
LaRose et al. (2011)	US college students	364	Age M = 17.76, SD = 0.741	Number of Facebook friends was not correlated with GPA
Kalpidou, Costin, and Morris (2011)	US college students	70	Age M = 19.61	Number of Facebook friends was negatively correlated with GPA.

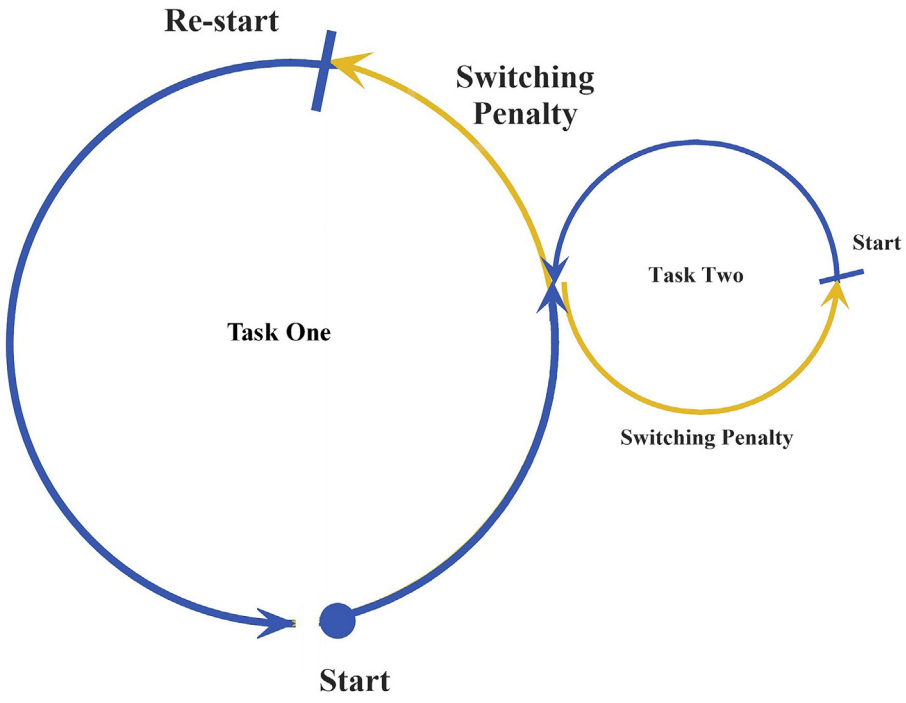

Fig. 6. Task switching between two tasks.

class. Our meta-regression findings became non-significant when only the college samples were included. More research is necessary to confirm this effect in the future.

6. Limitations and future studies

Clearly, this meta-analysis study is limited by the samples it analyzed. First, most studies we found were cross-sectional and correlational in nature, therefore it is impossible to determine causal mechanisms between SNS-use, multitasking, and academic performance. While the data shows that SNS-use and GPAs are negatively related, the direction of the effect is difficult to determine. For instance, it could be that students who spend more time on SNSs have lower GPAs while it might be that students with lower GPAs tend to spend more time on SNSs. Further, longitudinal and quasi-experimental studies are needed to determine the mechanisms of causation. Secondly, future research (e.g., Karpinski, Kirschner, Shreffler, Albert, & Tomko, 2016) shall examine the relationship between specific SNS activities, gratifications and academic performance. This would allow researchers to further explain how SNS-use and multitasking are related to academic performance. However, now, we have accumulated no sufficient evidence to conduct separate meta-analyses for different types of SNS-use and academic performance. Finally, it should be noted that the negative relationship between SNS-use and academic performance we confirmed may be just one dark side of SNS-use (Liu & Baumeister, 2016). However, it does not mean that SNS-use is bad. In fact, SNS-use may also bring about benefits such as accruing social capital (Liu, Ainsworth & Baumeister, 2016; Liu & Brown, 2014; Liu, & Campbell, 2017; Liu & Yang, 2016).

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Appendix

Table 1
Studies included in global SNS use and Academic performance meta-analysis.

Author	Correlation	Sample	Stage	Female	SNS	GPA	Test	Design
LaRose, 2015	−.19	364	College	.70	Time	NA	GPA	C
Lee Y. H., 2013	.05	87,735	High School	.50	Time	NA	LIT	C
Ainin, 2015	.08	1165	College	.60	Intensity	NA	GPA	C
Paul, 2012	−.12	340	College	.52	Time	3.19	GPA	C
Karpinski, 2009	−.27	451	College	.62	Time	2.7	GPA	C
Lubis, 2012	.15	78	College	NA	Time	3.23	GPA	C
Glass, 2013	−.15	255	College	.37	Time	NA	GPA	C
Al-Menayes, 2014	−.26	308	College	.66	Time	NA	GPA	C
Kalpidou, 2011	−.04	35	College	.67	Time	NA	GPA	C
Kalpidou, 2011	.07	35	College	.67	Time	NA	GPA	C
Kabre, 2011	.09	209	College	.58	Time	2.84	GPA	C
Junco, 2012a	−.04	1839	College	.64	Time	2.95	GPA	C
Lee R., 2015	.08	3628	College	.52	NA	NA	GPA	C
Pasek, 2009	−.15	303	High School	NA	Frequency	NA	GPA	L
Skiera, 2015	.01	117	College	.48	Frequency	2.46	GPA	C
Alloway, 2013	.15	104	High School	.52	Frequency	NA	LIT	C
Moon, 2011	−.13	202	College	.38	Time	3.1	GPA	C
Michikyan, 2015	−.17	261	College	.74	Time	2.44	GPA	C
Jacobsen, 2011	−.10	1026	College	.65	Time	3.28	GPA	C
Haddad, 2013	.03	53	College	.47	Time	NA	GPA	C
Pasek, 2009	.01	1049	College	.45	NA	NA	GPA	C
Pasek, 2009	.12	660	High School	.56	NA	NA	GPA	C
Ogedebe, 2012	.03	122	College	.44	NA	NA	GPA	C
Alexander, 2012	−.23	72	High School	.60	Intensity	NA	GPA	C
Kashif, 2013	−.11	344	College	.64	Time	NA	GPA	C
Brubaker, 2013	.03	73	College	.41	Time	NA	GPA	C
Hyatt, 2011	−.06	613	College	.68	Time	NA	GPA	C
Karpinski, 2009	−.61	451	College	.78	Time	3.4	GPA	C

Note. Stage refers to educational stage; SNS time refers to SNS measure type; Test refers to academic performance; LIT refers to literacy GPA; Design refers to study design. C refers to cross-sectional; L refers to longitudinal design.

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