

# The Context of College Students' Facebook Use and Academic Performance: An Empirical Study

Yiran Wang

Department of Informatics  
University of California Irvine  
wyr4137@gmail.com

Gloria Mark

Department of Informatics  
University of California Irvine  
gmark@uci.edu

## ABSTRACT

The effects of Facebook on academic performance have attracted both public and scholarly attention. Prior research found that Facebook use is linked to poor academic performance, suggesting that Facebook distracts students from studying. These studies, which are primarily based on survey responses, are insufficient to uncover exactly how Facebook is used or embedded in students' studying activities. To capture unbiased, detailed use patterns and to investigate the context of Facebook use, we studied 50 college students using automatic logging and experience sampling. We analyzed the activities and attentional states of students prior to visiting Facebook. Results show that GPAs of frequent Facebook users do not suffer. Students with high GPAs spend shorter time in each Facebook session and shorter Facebook use often follows schoolwork. These results point to a possibility that potentially problematic Facebook use occurs when students are in a spree of leisure activities, not while studying.

## Author Keywords

Facebook; academic performance; attention; college students; logging; experience sampling.

## ACM Classification Keywords

H.5. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

Despite the growing number of studies, the effect of Facebook use on students' academic work remains an open question (see [23] for a review). This line of research is largely rooted in the concern that the younger generation might have irreversibly developed habits of scattered attention because of pervasive information and communication technologies [6, 39]. Researchers and the public are particularly concerned about social media for its entertaining properties and the lightweight social interactions it affords, which can increase multitasking and

hinder learning. Facebook in particular is important to examine given its popularity, multi-faceted purposes in college, and its relevance to contemporary learning.

On the one hand, Facebook is widely adopted by college-aged young adults [12] and serves important functions in college life. It facilitates social interaction and satisfies young adults' psychosocial needs [10, 24, 30]. It can be used as a quick break from study or as short-term stress relief [25, 30, 40]. It can also be used as a platform for teaching and learning, supplementing classroom learning [5, 8]. All these uses and effects of Facebook can positively impact a student's academic performance.

On the other hand, studies have argued that Facebook use is associated with increasing levels of multitasking, harmful for students' learning (e.g., [13, 15, 34]). Though studies generally point to a negative relationship between Facebook use and academic performance [23], inconsistent results, likely due to methodological limitations, show that this line of research is still in its early stage. For example, some studies found no relationship between Facebook use and students' academic performance [19, 28, 40], some found a negative relationship [14, 15, 17, 18, 41]), and some found a positive relationship [2]. While these studies mainly rely on a single method (primarily surveys), recent studies (e.g., [27]) advocate for the necessity of a mixed-methods approach to uncover what students do on Facebook and how, in order to better understand whether Facebook use and academic learning are related, and in what direction. Furthermore, a recent meta-review [23] maintains that educational and informational use of social networking sites (SNS) positively correlates with GPA, while social use of SNS negatively correlates with GPA. Since the functions and norms of Facebook have evolved over time [3, 35], studies have found that users have trended away from social use of Facebook (e.g., broadcasting their personal whereabouts) toward informational use (e.g., reading news and engaging with current events) [3]. As a result, the dynamic of positive and negative influence on academic performance might also change.

Given the inconsistent results in prior research, the call for more methodologically sound studies, and the evolving uses of Facebook in college life, the overall question that guides this study is: How does Facebook use relate to academic performance? We approach this question by investigating how Facebook fits into college students' daily activities. In

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

CHI 2018, April 21–26, 2018, Montréal, QC, Canada.  
© 2018 ACM ISBN 978-1-4503-5620-6/18/04...\$15.00.  
<https://doi.org/10.1145/3173574.3173992>

particular, we not only examine a variety of Facebook use metrics through automatic logging, but also investigate the *context* in which Facebook is used—students’ activity prior to Facebook and the quality of their attention right before Facebook use. To the best of our knowledge, this is the first study on Facebook and academic performance that focuses on the context of Facebook use. It extends prior work by uncovering how college students embed Facebook in their lives, what their attentional characteristics are when they check Facebook, how their Facebook use differs according to context, and whether and in what ways their academic performance is impacted by any of these factors.

### **FACEBOOK AND ACADEMIC PERFORMANCE**

Academic research on Facebook use and academic performance started to appear almost a decade ago. The first few studies [18, 19, 28] compared the academic performance between Facebook users and nonusers in college. Perhaps as a result of the coarse measures, they found mixed results. Two reported no relationship [19, 28] while one reported Facebook users having lower academic performance with the explanation that it was an opportunity cost: using Facebook took time away from studying [18]. Later research mainly explored the time and frequency of Facebook use. Most studies found that heavy Facebook use is associated with lower academic performance [14, 17, 23, 29, 34, 41]. For instance, Junco [14] reported that both the duration of time and checking frequency were negatively correlated with student GPAs. However, they also found that Facebook checking was not associated with the time spent in preparing for class, suggesting that time on Facebook might not affect time on schoolwork.

The studies that found Facebook detrimental to academic learning mainly attributed the negative impact to multitasking: using Facebook while studying fragments students’ attention and interferes with deep learning that requires focus. Specifically, Junco and Cotten [15] used self-reported time and self-reported multitasking in surveys—e.g., “*I very frequently do schoolwork at the same time that I am using Facebook*”—to reach such a conclusion. Yet, studies have shown that self-reports of computer and Facebook usage are not an accurate representation of the actual usage [7, 16]. Using trained student observers to take notes in participants’ natural studying environments, Rosen et al. [34] found that students who used Facebook at least once in a 15-minute study session have lower GPAs, suggesting that switching from studying to Facebook is distracting even though no observation was made on what the students did on Facebook or whether Facebook distracted them in the first place. Striving to avoid the bias from self-reports, Judd [13] logged students’ studying sessions using automatic computer logging. With the observation that Facebook use often appeared in the same sequence as studying, and that Facebook use was linked to an increased level of multitasking, he suggested that Facebook use is likely to

hinder academic performance; however, academic performance was not measured in this study.

### **STUDY MOTIVATION**

In sum, these studies are all limited methodologically and are insufficient to uncover exactly how Facebook use is embedded in students’ studying activities or how it affects their studying. The assumption made in these studies, which we question, is that the co-occurrence of Facebook use and studying activities implies that Facebook distracts students from studying. According to a recent study that combined both automatic logging and self-reported surveys [40], the GPAs of college students who checked social media sites (primarily Facebook) frequently throughout the day were not different from those of infrequent social media checkers, despite the higher perceived distraction for continuous checkers. Another recent study that adopted a mixed-methods approach [27] also questioned the direction of the relationship, reporting that students who struggled academically were more likely to increase Facebook activity level as they used Facebook to cope with frustrations in studying. Given the inconsistent results and the necessity of triangulating multiple data sources, *our first research goal is to examine the relationship between students’ academic performance and Facebook use, taking into account the frequency of checking, time spent in Facebook, and activities on Facebook through automatically tracked data.*

In addition, we seek to go beyond examining Facebook use metrics to consider the context in which Facebook is used. Studies claimed that Facebook consumed students’ limited cognitive resources reserved for studying [15, 34], and yet no observations on students’ quality of engagement with Facebook or schoolwork were made. Similarly, even with relatively accurate behavioral logs [13], when students’ attentional state is not measured, it is impossible to conclude that Facebook use has caused students to shift attention from their main tasks. We are not disputing the possibility that Facebook use can interfere with students’ focus on schoolwork; we simply need to propose an alternative possibility—a student might go on Facebook when they are already unfocused or tired, and the use of Facebook might serve as a break to allow students to rejuvenate. Our reasoning for this conjecture is two-fold. First, social media use is found to be associated with stress relief for college students [25]. Office workers have also described short social media use as a routine “micro-break” used to relax without losing concentration [38]. Second, studies that focus on information workers suggested that users might already be in an “unfocused” state prior to Facebook and thus prone to visiting Facebook [26]. The activity and the associated attentional states prior to Facebook can influence why a student wants to check Facebook, which is under-studied. *Thus, our second research goal is to investigate how the context in which Facebook is used—activities and the associated attentional*

*states immediately before using Facebook—affects a student’s actual Facebook use.*

Here we operationalize two measures used in this study. We chose student engagement, a construct measured in the dimensions of concentration, interest, and enjoyment, as a proxy for students’ attention associated with an activity [36, 37]. This measure was chosen because it is tested on the student population in the educational context. Specifically, concentration is the selective allocation of cognitive resources, which reflects the “depth of cognitive processing” [37, p.133]; interest demonstrates a student’s intrinsic motivation and can direct their attention; and enjoyment indicates “competencies and creative accomplishment” [37, p.133]. High levels of engagement, both in the aggregate of the three dimensions and in each individual dimension, were correlated with high levels of challenge and skill, an indication for the flow experience [36]. We used cumulative grade point average (GPA) as a measure of academic performance as it is connected to class achievement [33]. The cumulative GPA, ranging from 0-4.0, is a weighted average of a student’s grades of all courses they have taken, representing their overall academic performance so far.

## METHOD

To collect Facebook usage data that includes accurate summary statistics (e.g., time, frequency) as well as detailed activities on Facebook, we chose to use automatic logging over self-reported measures. The experience sampling method [20, 22] allows researchers to collect relevant contextual information from a student while they go about their typical Facebook use; thus we used it in this study.

## Recruitment

Participants were recruited from a major public university on the U.S. west coast from December 2015 to February 2016. We made announcements in large undergraduate classes and posted subject recruitment advertisements on the official university Facebook groups for the classes of 2016–2019, as a large number of current students were affiliated with these groups. After the initial recruitment, we sent out a screening survey to collect potential participants’ frequency of Facebook use, primary platform of Facebook use, year in school, and major.

This paper is part of a larger study investigating Facebook use in college students’ learning ecology, including formal learning measured in academic performance and interest-driven, informal learning. As a result, we only recruited regular Facebook users. Furthermore, the scope of this paper is on the computer version of Facebook as students primarily conduct their schoolwork on the computer.

From a pool of 126 eligible candidates, we selected 50 students to participate in a weeklong study. This sample of students self-reported to use Facebook at least three times a day on the computer; comprised a relatively balanced representation of gender (female=29) and class standing

(freshman=11, sophomore=12, junior=13, senior=14); ages ranged from 18-25, with a median age of 20; and they came from 24 distinct majors, covering a variety of STEM and non-STEM fields. The study was approved by the university’s institutional review board.

## Data Collection Tool—ROSE

An open-source browser extension—Research tool for Online Social Environments (ROSE<sup>1</sup>) [11, 32]—was customized for data collection. From a computer browser, ROSE automatically collects user activities (e.g., making a comment), records usage statistics (e.g., window active time, page scrolling), and administers experience sampling (ES) surveys. From May to November 2015, we collaborated with the developers and researchers of ROSE to modify the tool so that it could 1) monitor all site-specific activities on Facebook (e.g., posting a Facebook status; join an event); 2) display ES survey questions; and 3) trigger the surveys with the right timing. Multiple iterations of code modification and pilot testing were conducted to ensure the data collection accuracy. Two versions of ROSE, a Chrome version and a Safari version, were used for data collection.

## Study Procedure

One researcher ran six to nine participants in a given week—Monday to the end of Sunday—due to scheduling. Data collection took place from February to April 2016 for all 50 participants. Table 1 summarized the participant characteristics for different weeks. No significant differences in GPA, total time on Facebook, or frequency of checking Facebook were found between subjects in the six weeks.

On day one (Monday), participants came to a set-up meeting where we explained the procedure and the types of data to be collected. They consented and installed ROSE on the browser of their personal laptops. Participants were instructed to use Facebook normally and to fill out ES surveys the moment they showed up on the computer screen for the next seven days. Details about the ES surveys will be presented in the next section. We also asked participants to keep diaries in ROSE and conducted semi-structured interviews with them after the weeklong study to understand students’ informal learning on Facebook, which

Batch	School Year (# Participant)				Gender (# Participant)		Avg GPA
	1	2	3	4	F	M	
1	6	0	1	2	5	4	3.11
2	0	3	1	4	5	3	3.13
3	3	1	4	1	7	2	3.04
4	0	0	4	2	4	2	3.03
5	2	1	3	3	4	5	2.92
6	0	7	0	2	4	5	3.16

Table 1. Participant characteristics for each week

<sup>1</sup> <https://github.com/secure-software-engineering/rose>

is outside of the scope of this paper thus not reported.

At the end of the 7-day study, we downloaded the Facebook use logs and ES survey responses from participants' laptops. A general survey was used at the end of the study to collect students' cumulative GPAs and demographic information. Each participant was provided \$50 compensation upon the completion of the study.

## Data Overview

### Facebook usage logging

Various types of usage data were tracked when a student used their computer browser to go on facebook.com: window active status, active user interaction, and browsing statistics. For privacy reasons, all content information (e.g., posts, pictures, user names) was stored as unique identification numbers instead of the actual content.

Window active status captures when a student visits Facebook and for how long, representing an overall degree of use. When a Facebook webpage was open and currently in focus, window active status was marked True; when the page was currently not in use (i.e., user switched to another webpage or application, or closed the Facebook page), window active status was marked False. All records were time stamped. Using window active status, we calculated the length of time a student spent on Facebook for each visit and the frequency of visiting Facebook.

Active user interaction records the occurrence of specific social networking activities and direct communication such as chat. Specifically, social networking activities (referred to as social interaction) collected in this study include: *like* (a post, a comment, or a page), *comment* (on a post or other comments), *share* (in a status update or in a private chat), *friend* (adding, confirming, or rejecting a friend request), *event* (responding to an event invitation), and *curate* (deleting a status update, un-friending, or un-liking content or pages previously liked). The occurrences of social interactions were time stamped.

*Browsing* provides a supplementary measure of content consumption that active user interaction might not capture. For instance, a student might browse through a large number of posts without using Facebook functions to socialize. Specifically, ROSE records a summary statistic of page scrolling, measured in pixels, when a student was on Facebook. Page scrolling measures the vertical pixels moving in and out of the user view by scrolling down the page, representing the amount of content a student views (or at least scrolls past). Since the total volume of browsing was strongly positively correlated with the duration of time on Facebook, we divided the total volume of browsing by the total time in order to reflect the degree of browsing. This browsing in a time unit indicates how "fast" a student browsed through Facebook content. Altogether, the overall degree of use (duration, frequency), active user interaction, and browsing provide a multi-faceted record of a student's Facebook use pattern.

### Experience sampling

To sample the context of Facebook use—specifically the conditions prior to Facebook use—ROSE displays a survey triggered by the activation of a Facebook webpage (referred to as pre-FB survey, see Figure 1). When a student opened a Facebook webpage, a pre-FB survey slid in on the left side of the screen automatically. The survey asked participants: "What was the last thing you did right before you came to Facebook?" To reduce participants' burden, four categories were provided: *schoolwork not on the computer*, *schoolwork on the computer*, *non-work not on the computer*, *non-work on the computer*. The pre-FB survey also asked participants to "Please rate the following scales based on how you felt right before you came to Facebook:" concentration, interest, and enjoyment (9-item Likert scales) [36, 37].

Though an ES survey takes a few seconds to complete, too many surveys could have interrupted students' normal use or discouraged them from going on Facebook as often as they usually would. To avoid a change of Facebook use behavior, a delay trigger was implemented such that once a survey was submitted, no survey would be triggered in the following 30 minutes.

### Data Preprocessing—Facebook Sessions

In total, 50 participants submitted 1350 pre-FB surveys, averaging approximately three to four pre-FB surveys per participant per day. Twenty surveys were incomplete, and consequently excluded from data analysis. Facebook usage logs and pre-FB surveys were organized in a chronological timeline for each participant. Each line of data contains the data type, its corresponding value, and its timestamp.

The duration of one *individual Facebook visit* is the time span between when a Facebook window became active and later went inactive, referred to as *per-visit duration*. The duration between the start of the current Facebook visit and the end of the last visit is referred to as *break duration*. Sometimes, when a user clicked on media content on Facebook, they were re-directed to a new browser tab to view the media content on its original site (e.g., CNN, YouTube); they then returned to Facebook a few seconds later and continued to use Facebook. In scenarios like this, it is likely that the user resumed their Facebook activity rather than starting anew. Therefore, it is necessary to

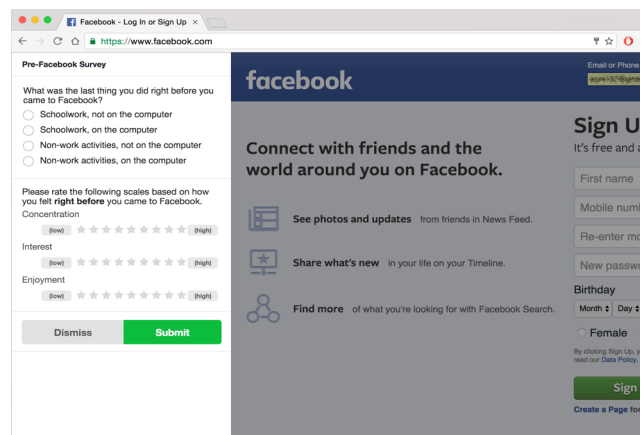


Figure 1. Pre-FB survey

consider a series of consecutive visits with brief breaks in between as one *Facebook session*.

The break duration ranged from 0.07 seconds to 171204 seconds (approximately 2 days). Most breaks between two consecutive Facebook visits were short: 90% of breaks were less than 1884 seconds (approximately half an hour); 50% of them were no more than 40 seconds. This further demonstrated the need to interpret Facebook use from a coarser granularity instead of treating each visit as independent and separate from each other. The key challenge, then, is to determine which Facebook visits should be grouped into one session and which ones in separate sessions, with no ground truth. This challenge has been documented in prior research on characterizing web browsing behavior [31]. Though various methods existed to determine session length [31], they require server-side log data, which we do not have for this study. With participants' Facebook usage log only, we considered seven break duration thresholds and subsequently aggregated the log data into seven datasets. We conducted analysis with all datasets and the results were largely consistent. Consequently, this paper only reports the results from one grouping mechanism—40 seconds, as it was the median break length.

*At the granularity of a Facebook session*, the following metrics for data analysis were calculated: *duration of use* (in seconds), *browsing in a time unit* (in pixels), *social interactions* (the total number of occurrence), *pre-FB last activity* (activities right before Facebook use), and *pre-FB attentional state* (ratings of concentration, interest, and enjoyment levels associated with the activity right before Facebook). Weekly summary statistics of these measures were also calculated.

## RESULTS

### Overview—Descriptive Statistics

The GPA of the sampled students is normally distributed: it ranged from 2.16 to 3.85, with an average of 3.07 (sd=0.44). The distributions of weekly total time, weekly total sessions, and per-session time on Facebook are all skewed to the right (see a summary in Table 2). Despite the substantial total time on Facebook in a week (median = 3 hr

57 m), the duration of each session was short: the median time a student spent on Facebook was 48.4 seconds per each session. Not only were Facebook sessions short in duration, 38% of sessions had no browsing (i.e., page scrolling), suggesting that it is not uncommon for students to go on Facebook for “a peek” without moving past the initial screen. In addition, a Facebook session often lacks social interaction: 82.8% of sessions had zero occurrences of any of the social networking activities.

Based on all pre-FB surveys submitted at the start of a Facebook session (Table 3), two thirds of activities immediately preceding Facebook use were non-work activities, either on the computer or offline. Schoolwork on the computer only occurred 25.6% of the time before Facebook use and schoolwork offline was the least common (7.7%). We reduced the 4-level pre-FB activity into a 2-level grouping given 1) the small size of the schoolwork offline group, and 2) the similar attentional characteristics between schoolwork online and offline, and between non-work online and offline. That is, schoolwork online and offline were grouped into one “Schoolwork” category, and non-work online and offline were grouped into one “Leisure” category. As shown in Table 3, students visited Facebook after leisure activities much more often than after schoolwork.

Based on the histogram of weekly total Facebook sessions (i.e., the total amount of time a student checked Facebook), we labeled students as *high checkers* and *low checkers*, if their amount of Facebook sessions was in the top one-third percentile and bottom one-third percentile, respectively. We have 16 high checkers who checked Facebook on average 32 times a day (sd=15.34) and 16 low checkers who checked Facebook on average 5 times a day (sd=2.48). Note that this study recruited only regular Facebook users; this is the reason why our category of low checkers used Facebook on average of five times a day. In the following analysis, Chi-square tests were used to compare categorical variables, independent t-tests (parametric) were used to compare normally distributed continuous variables, and Mann-Whitney U tests (nonparametric) were used to compare continuous variables that are not normally distributed.

	<b>Min.</b>	<b>Max.</b>	<b>Mean</b>	<b>SD</b>	<b>Median</b>
<b>Weekly Total time on FB in sec. (h:mm:ss)</b>	1157 (0:19:17)	77237 (21:27:17)	16607.7 (4:36:48)	12577.7 (3:29:38)	14270 (3:57:50)
<b>Weekly Total FB visits</b>	9	1057	233.1	214.5	174
<b>Weekly Total FB sessions</b>	7	493	119	99.6	92
<b>Duration per FB visit in sec.</b>	0.04	3208.5	71.2	147.4	19.2
<b>Duration per FB session in sec.</b>	0.2	4643.8	139.5	253.1	48.4

Table 2. Summary of Facebook usage in the weeklong study.

2-level pre-FB activity		4-level pre-FB activity from ES	
Leisure	66.7%	Non-work on computer	29.2%
		Non-work offline	37.5%
Schoolwork	33.3%	Schoolwork on computer	25.6%
		Schoolwork offline	7.7%

**Table 3. Activities prior to Facebook visits, reported from pre-FB surveys**

### Comparing High and Low Facebook Checkers

We first compared the personal characteristics of high and low checkers. No significant differences were found in gender, year in school, or GPA between these two groups.

Next, we compared Facebook use metrics between high and low checkers. We used False Discovery Rate [4] for correcting multiple comparisons in Table 4a and 4b. As shown in Table 4a, high checkers spent more total time on Facebook in a given week—more than three times as much—than low checkers. For each Facebook session, however, high checkers spent less time—about half the time—than low checkers. In addition, high checkers engaged in less social interaction per session. Yet, high and low checkers did not differ in the amount of pixels they scrolled down in a time unit, indicating that how “fast” they browsed Facebook was similar.

In addition to personal characteristics and Facebook use metrics, we compared the attentional levels associated with the activity prior to Facebook for high and low checkers. All pre-FB survey ratings from each student were averaged, resulting in a global measure of concentration, interest, and enjoyment per student. Overall, high checkers had higher interest levels in the activity they did *prior* to Facebook, contrary to what we expected (Table 4b).

We further divided Facebook sessions into those that occurred after Schoolwork and those after Leisure, and calculated an average for each use context per student. Results show that the percentage of Facebook sessions that occurred after Schoolwork (SW%) is similar in both groups. When students went from Leisure to Facebook, high checkers had higher interest in the Leisure activity than low checkers.

Taken together, we expected that students who checked Facebook frequently—averaging 32 times a day—would have lower GPAs, as previous studies repeatedly suggested that heavy use of Facebook is associated with multitasking, which negatively impacts GPA. Our results however showed no difference in GPA between high and low checkers. So what factors might be associated with GPA, if not the frequency of checking Facebook? We also expected that high checkers visited Facebook so frequently because they had low engagement in the activity prior to FB, and are thus prone to distractions that were either from external interruptions (e.g., notifications on Facebook) or self-interruptions [1, 9]. The results however showed that high checkers had higher interest in the activity prior to checking

Variables	High checkers (m, sd)	Low checkers (m, sd)	Test statistics <sup>1</sup>	p*
GPA	3.13 (0.46)	2.94 (0.48)	t(30)=1.19	.24
Weekly FB duration (sec.)	26407.57 (16135.25)	8181.83 (5157.12)	U=19	<.004
Avg duration per-session (sec.)	116.47 (38.38)	212.36 (106.89)	U=47	.004
Avg browsing (pixel per sec.)	114.10 (51.82)	95.75 (51.05)	t(30)=1.01	.32
Avg #social interactions per-session	0.23 (0.18)	0.89 (0.90)	U=69	.04

**Table 4a. Results comparing high and low Facebook checkers on GPA and Facebook use metrics. For parametric tests, we reported T statistics; for nonparametric tests, we reported U statistics. \*p values are adjusted for multiple comparisons [4].**

Variables	High checkers (m, sd)	Low checkers (m, sd)	Test statistics <sup>1</sup>	p*
Avg concentration	5.76 (1.08)	4.69 (1.50)	t(30)=2.31	.075
Avg interest	5.44 (0.87)	4.37 (1.31)	t(30)=2.73	.05
Avg enjoyment	4.97 (1.17)	4.39 (1.35)	t(30)=1.29	.26
SW%	34.46% (16.57%)	39.27% (16.32%)	t(30)=-.83	.47
Avg SW concentration	6.41 (1.27)	5.24 (1.88)	t(30)=2.06	.10
Avg SW interest	4.45 (1.32)	3.76 (1.59)	t(30)=1.34	.26
Avg SW enjoyment	3.48 (1.55)	3.56 (1.49)	t(30)=-.15	.89
Avg L concentration	5.50 (1.35)	4.22 (1.49)	t(30)=2.57	.07
Avg L interest	6.01 (1.17)	4.62 (1.35)	t(30)=3.12	.004
Avg L enjoyment	5.78 (1.36)	4.83 (1.73)	t(30)=1.74	.15

**Table 4b. Results comparing high and low Facebook checkers on attentional states. SW: schoolwork; L: leisure. \*p values are adjusted for multiple comparisons [4].**

Facebook, pointing to a possibility that using Facebook and doing other activities might not be a zero-sum game. The next two sections investigate these two subjects further.

### Comparing High GPA Students and Low GPA Students

To find out what Facebook use metrics, if any, are associated with academic performance, we grouped the students into *high GPA* (m=3.47, sd=0.18) and *low GPA* (m=2.53, sd=0.19) groups, based on the top and bottom one-third percentile in GPA, respectively. We compared these two groups with the same list of variables from the last section (see Table 4a and 4b).

Results (Table 5) show that high GPA students spent less time on Facebook per each use session. Dividing Facebook sessions into those that occurred after Schoolwork and those after Leisure, we found no difference in per-session duration after schoolwork, but found a significant, large difference in per-session duration after Leisure: high GPA students spent nearly half the time in Facebook when it followed a Leisure activity. For each session, high GPA students engaged in less social interaction, measured by the number of occurrence of social networking activities. High and low GPA performing students, however, did not differ in the total amount of time on Facebook or the total amount of Facebook checking, the amount of browsing in a time unit, the percentage of time Facebook use followed schoolwork, or the average engagement levels (concentration, interest, enjoyment) prior to Facebook use.

### Pre-FB Experience Affects Facebook Use Metrics

To find out what affects the per-session duration of time and number of social interactions, in this section we focus on each Facebook use session. Particularly, we investigated whether students' activity and engagement levels right before Facebook affect the way they *use* Facebook, and if so, how.

Since each participant was repeatedly sampled through pre-FB surveys, linear mixed-effects models were used to account for the nested nature of the data. In two separate models, the dependent variables (DVs) were Facebook use metrics: duration and the number of social interactions. The independent variables (IVs) were pre-FB activity, concentration, interest, and enjoyment, along with the two-way interactions between pre-FB activity and the three dimensions of engagement. Individual participant was the random factor.

As shown in Table 6a and 6b, students spent longer time on Facebook if the Facebook session followed a leisure activity. While interest level had no significant main effect on Facebook duration, a significant interaction between pre-FB activity and interest affected the time a student spent on Facebook. Scatterplots showed that lower interest in the leisure activity before Facebook was related to longer time spent on Facebook; interest in schoolwork did not appear to have a clear relationship with duration on Facebook.

We also found a significant relationship between enjoyment and social interactions, though the effect size is small. The

Variables	High GPA (m, sd)	Low GPA (m, sd)	Test statistics	P
Avg duration (sec.)	139.57 (65.53)	230.03 (123.44)	U=88	.02
Avg duration after L (sec.)	217.17 (84.01)	414.57 (253.63)	U=65	.002
Avg #social interactions	0.45 (0.57)	0.90 (0.76)	U=97	.05

**Table 5. Independent t-tests results comparing high and low GPA students. Only significant results are shown.**

IV	DVs			
	Duration		Social Interaction	
	F (num, den)	P	F (num, den)	P
Pre-FB activity	4.30	.04	1.15	.29
Concentration	.04	.84	.04	.84
Interest	.11	.75	.84	.36
Enjoyment	1.05	.31	4.52	.03
Pre-FB activity x C	1.43	.23	.44	.51
Pre-FB activity x I	5.22	.02	.02	.89
Pre-FB activity x E	.05	.82	.02	.90

**Table 6a. Tests of fixed effects in two linear mixed models. F statistics are presented, numerator df = 1, denominator df = 1181. Pre-FB activity has two levels: Schoolwork vs. Leisure. C: Concentration, I: Interest, E: Enjoyment**

DV	IV	Estimates (SE)
Duration	Pre-FB activity: Leisure <sup>1</sup>	115.99 (55.92)
	Pre-FB activity x Interest <sup>1</sup>	-34.29 (15.00)
# Social interaction	Enjoyment	.09 (.07)

**Table 6b. Coefficients for significant results. <sup>1</sup>Schoolwork is the reference category with estimate=0.**

higher the enjoyment associated with the activity immediately before Facebook use, the more social interactions a student engaged in on Facebook. In sum, at the granularity of each Facebook use session, we found that pre-Facebook context affects the amount of time and social interaction a student engaged in during Facebook use.

## DISCUSSION

This study sets out to answer *how Facebook use relates to academic performance*. We approached this question using automatically tracked usage logs and repeated experience sampling of students' personal contexts in which Facebook use occurred. The main findings are:

- Frequent and infrequent Facebook checkers' academic performance, as measured by GPA, showed no difference. Frequent checkers spent longer total time on Facebook. For each use session, however, they spent a shorter duration and engaged in less social interaction. Frequent checkers' overall interest in the activity prior to Facebook was higher.
- High and low performing students based on GPA differed in the amount of time they spent in each Facebook use session: low GPA students on average spent longer time, particularly after a leisure activity.
- Based on the unit of each Facebook use session, students spent longer duration on Facebook if the Facebook session followed a leisure activity. If a student's interest in the leisure activity prior to Facebook was low, they are likely to spend even longer time on Facebook.

### **How Facebook is used is more important than the overall degree of use**

Higher degree of overall Facebook use does not necessarily influence academic performance; how a student uses Facebook each time does. Frequent checkers visit Facebook briefly, for an average of 32 times in a day. Yet, their academic performance is on par with students who use Facebook relatively infrequently. This result contradicts a number of prior studies that found Facebook use relates to lower GPA, especially when students multitask between Facebook and studying [14, 15, 17, 34]. We explain this discrepancy as follows. First, some studies might have suffered from methodological limitations from self-reported data of coarse granularity, such as a one-time estimate of general Facebook use time, frequency, and degree of multitasking [14, 15, 29]. Second, some studies only investigated a snapshot of studying time, such as in class [41] or in a 15-minute study session [34], which is not representative of a student's overall Facebook use day in and day out.

In contrast to these studies, we used browser tracking that automatically logged students' Facebook use, free of biases from self-reporting and accurate to the millisecond. The fine granularity of data allows us to identify *exactly* what types of Facebook use might be responsible for students' different GPAs. Specifically, we have shown that general measures of Facebook use—e.g., frequency, total time—do not differentiate high and low performing students. Instead, the characteristics of each use do: high GPA students spend shorter duration and engage in fewer numbers of social interactions each time they use Facebook. It is worth noting that the result of no difference in GPA between frequent and infrequent checkers is consistent with Wang et al.'s study [40] that also employed automatic tracking for an extended period of time.

### **Why does frequent Facebook checkers' GPA not suffer?**

Even though high checkers use Facebook very frequently throughout the day, they don't check Facebook more often with studying than those who use Facebook less frequently, as evident in the similar overall percentage of Facebook sessions after schoolwork (SW%) between high and low checkers. In other words, higher degree of Facebook use does not necessarily indicate that students interweave Facebook use with studying more.

Furthermore, the fact that 1) high checkers' interest in the activity prior to Facebook is higher than low checkers and 2) high checkers spend shorter time on Facebook suggest that they might be more alert when they start Facebook use, and such alertness promotes better self-regulation on Facebook. When a student is on Facebook and alert, they might be more likely to interrupt and curtail their own Facebook use. This implication challenges and refutes the idea that students who check Facebook frequently do so because they could not focus on studying and thus are prone to distraction.

### **Leisure activities and Facebook use**

Since per-session duration is an important factor that relates to GPA, figuring out under what circumstances students use Facebook for a shorter duration is crucial. We found that when Facebook use followed schoolwork, students spent less time on Facebook. With this result, we do not intend to suggest that students *should* study and then check Facebook. Rather, we want to bring attention to the opposite: students should avoid visiting Facebook as part of an "entertainment binge." When Facebook use followed leisure activities, students exhibited prolonged use, which is potentially problematic as it relates to lower GPA. Specifically, longer use sessions suggest that Facebook use right after a leisure activity could be more unrestricted. When a student's interest was already low in the leisure activity prior to Facebook, they spent even longer time on Facebook. These results suggest that prolonged and potentially problematic Facebook use is likely to occur when students are in a lethargic "play" mode. Since Facebook use more often followed leisure activities (67% of the time) rather than schoolwork (33% of the time), as shown in this study, we strongly urge future research to pay attention to Facebook use when a student is not studying.

### **Generalizability and Limitations**

There are a few limitations in this study.

*Student sample.* This study only recruited regular Facebook users who primarily use Facebook on their computers because that is where students primarily conduct their learning activities. Thus the results can only be generalized to a college student population who regularly checks Facebook on their computers. Mobile Facebook use has been rapidly increasing in recent years [21]. College students' total time on Facebook and frequency of checking could potentially be much larger than those captured in this paper. Students could also allocate and negotiate attention differently when switching between studying and mobile Facebook use. According to a recent study [21], research that explores differences in Facebook use across platforms is still nascent. Researching mobile Facebook use in conjunction with and in comparison to computer-based Facebook with regards to academic performance would be important for future work.

*Running the study in different weeks.* We acknowledge that different weeks in a school year could potentially affect how and how much Facebook is used. However, we did not find any significant difference between participant groups in the six weeks of running the study regarding the total time, frequency of checking, per-session time, or percentage of Facebook use after schoolwork. In addition, students from different weeks do not significantly differ in their GPAs. Thus, we believe the between-week variation did not affect the results of the study.

*Creating Facebook sessions.* A threshold of 40 seconds was used to create Facebook sessions—if the time span between two consecutive Facebook visits (break duration) was less



than 40 seconds, then these multiple visits were combined and considered to be in one Facebook session. We did test different break durations for our measures and found consistent results. However, the threshold could be overly generalized as we had no ground truth. We recommend future studies to consider observing participants *in-situ* regarding when they switch in and out of Facebook, and for how long; or to log all computer activities in addition to tracking Facebook use in order to establish a more accurate break time threshold.

*Experience sampling.* In reporting the activity prior to Facebook, schoolwork (online, offline) and non-work (online, offline) were the only two major categories provided in the ES. As a result, we have potentially missed non-schoolwork related work activity. A small number of students mentioned their part-time jobs in interviews; these jobs, however, did not require computer use (e.g., babysitting, campus tour guide). It is possible that these students reported their non-schoolwork work activity prior to Facebook use under the non-work category, which we called leisure in this paper. In addition, we only sampled the activity and students' attentional states prior to Facebook use, not after. Future research can extend this study by 1) including a non-schoolwork work category and 2) examining the activity, the associated attentional states, and productivity immediately after Facebook use to further investigate the distracting effect (or the lack thereof) of Facebook.

## **CONCLUSION**

Though past studies generally point to a negative relationship between Facebook use and academic performance, our study has provided evidence that the relationship is far more nuanced. Using more precise measures of Facebook use than previous studies, we found that people who check Facebook frequently are no different in academic performance than those who check infrequently. The difference between high and low performing students appears to be in how Facebook is used each time. Low GPA students spend longer time in each use and Facebook use that follows leisure activities tend to be longer in duration. Further research is needed to understand more clearly why some students engage in brief Facebook use while others engage in prolonged use. We have suggested some directions, such as alertness and self-regulation. We have also suggested a new direction for the future investigation of social media use and academic performance in college life: examining Facebook use in leisure time.

## **ACKNOWLEDGMENT**

We thank Felix Epp, Andreas Poller, and Oliver Hoffmann for their invaluable help in customizing the data collection tool ROSE for this study. We greatly appreciate the insightful feedback from all reviewers. And we thank our participants for their interest and time.

## REFERENCES

1. Rachel F. Adler and Raquel Benbunan-Fich. 2013. Self-interruptions in discretionary multitasking. *Computers in Human Behavior* 29, 4: 1441-1449
2. Sulaiman Ainin, M. Muzamil Naqshbandi, Sedigheh Moghavvemi, and Noor Ismawati Jaafar. 2015. Facebook usage, socialization and academic performance. *Computer & Education* 83:64–73.
3. Michael Barthel, Elisa Shearer, Jeffrey Gottfried, and Amy Mitchell. (14 July, 2015). News use on Facebook and Twitter is on the rise. *Pew Research Center*. Retrieved September 15, 2017 from <http://www.journalism.org/2015/07/14/news-use-on-facebook-and-twitter-is-on-the-rise/>
4. Yoav Benjamini and Yosef Hochberg. 1995. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the royal statistical society* 57, 1: 289-300.
5. Jeff Cain and Anne Policastri. 2011. Using Facebook as an informal learning environment. *American Journal of Pharmaceutical Education* 75:10, Article 207.
6. Nicholas Carr. 2008. Is Google making us stupid? *Yearbook of the National Society for the Study of Education* 107, 2: 89-94.
7. Fred Collopy. 1996. Biases in retrospective self-reports of time use: An empirical study of computer users. *Management Science* 42, 5: 758-767.
8. Nada Dabbagh and Anastasia Kitsantas. 2012. Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education* 15, 1: 3-8.
9. Laura Dabbish, Gloria Mark, and Victor M. González. 2011. Why do i keep interrupting myself?: environment, habit and self-interruption. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI'11)*, 3127-3130
10. Nicole B. Ellison, Charles Steinfield, and Cliff Lampe. 2007. The benefits of Facebook “friends”: Social capital and college students’ use of online social network sites. *Journal of Computer-Mediated Communication* 12, 4: 1143-1168.
11. Felix Epp, Oliver Hoffmann, and Andreas Poller. 2016. ROSE - Research Tool for Online Social Environments. [Computer Software] Darmstadt: Germany. Retrieved September 15, 2017 from <https://github.com/secure-software-engineering/rose>
12. Shannon Greenwood, Andrew Perrin, and Maeve Duggan (11 November, 2016) Social media update 2016. *Pew Research Center*. Retrieved September 15, 2017 from <http://www.pewinternet.org/2016/11/11/social-media-update-2016/>
13. Terry Judd. 2014. Making sense of multitasking: The role of Facebook. *Computers & Education* 70, 194-202.
14. Reynol Junco. 2012. Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Computers in Human Behavior* 28,1: 187-198.
15. Reynol Junco and Shelia R. Cotten. 2012. No A 4 U: The relationship between multitasking and academic performance. *Computers & Education* 59, 2:505-514.
16. Reynol Junco. 2013. Comparing actual and self-reported measures of Facebook use. *Computers in Human Behavior* 29, 3: 626–631.
17. Reynol Junco. 2015. Student class standing, Facebook use, and academic performance. *Journal of Applied Developmental Psychology* 36: 18-29.
18. Paul A. Kirschner and Aryn C. Karpinski. 2010. Facebook® and academic performance. *Computers in Human Behavior* 26, 6: 1237-1245.
19. Ethan A. Kolek and Daniel Saunders. 2008. Online disclosure: An empirical examination of undergraduate Facebook profiles. *NASPA Journal* 45, 1:1–25.
20. Mike Kuniavsky. 2003. *Observing the User Experience: A Practitioner’s Guide to User Research*. New York, NY: Morgan Kaufman.
21. Ozan Kuru, Joseph Bayer, Josh Pasek, and Scott W. Campbell. 2017. Understanding and measuring mobile Facebook use: Who, why, and how?. *Mobile Media & Communication* 5, 1: 102-120.
22. Reed Larson and Mihaly Csikszentmihalyi. 1983. The experience sampling method. *New Directions for Methodology of Social and Behavioral Science* 15: 41-56.
23. Dong Liu, Paul A. Kirschner, and Aryn C. Karpinski. 2017. A meta-analysis of the relationship of academic performance and Social Network Site use among adolescents and young adults. *Computers in Human Behavior* 77: 148-157.
24. Adriana M. Manago, Tamara Taylor, and Patricia M. Greenfield. 2012. Me and my 400 friends: the anatomy of college students' Facebook networks, their communication patterns, and well-being. *Developmental Psychology* 48, 2: 369-380.
25. Gloria Mark, Yiran Wang, and Melissa Niiya. 2014. Stress and multitasking in everyday college life: an empirical study of online activity. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*, 41-50.
26. Gloria Mark, Shamsi Iqbal, Mary Czerwinski, and Paul Johns. 2015. Focused, aroused, but so distractible:

- Temporal perspectives on multitasking and communications. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*, 903-916.
27. Minas Michikyan, Kaveri Subrahmanyam, and Jessica Dennis. 2015. Facebook use and academic performance among college students: A mixed-methods study with a multi-ethnic sample. *Computers in Human Behavior* 45: 265-272.
  28. Josh Pasek and Eszter Hargittai. 2009. Facebook and academic performance: Reconciling a media sensation with data. *First Monday* 14, 5.
  29. Jomon Aliyas Paul, Hope M. Baker, and Justin Daniel Cochran. 2012. Effect of online social networking on student academic performance. *Computers in Human Behavior* 28, 6: 2117-2127.
  30. Tiffany A. Pempek, Yevdokiya A. Yermolayeva, and Sandra L. Calvert. 2009. College students' social networking experiences on Facebook. *Journal of Applied Developmental Psychology* 30, 3: 227-238.
  31. Peter L.T. Pirolli and James E. Pitkow. 1999. Distributions of surfers' paths through the World Wide Web: Empirical characterizations. *World Wide Web* 2, 1-2: 29-45.
  32. Andreas Poller, Petra Ilyes, Andreas Kramm, and Laura Kocksch. 2014. Investigating OSN users' privacy strategies with in-situ observation. In *Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '14)*, 217-220.
  33. Steven B. Robbins, Kristy Lauver, Huy Le, Daniel Davis, Ronelle Langley, and Aaron Carlstrom. 2004. Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin* 130, 2: 261-288.
  34. Larry D. Rosen, L. Mark Carrier, and Nancy A. Cheever. 2013. Facebook and texting made me do it: Media-induced task-switching while studying. *Computers in Human Behavior* 29, 3: 948-958.
  35. Sarita Schoenebeck, Nicole B. Ellison, Lindsay Blackwell, Joseph B. Bayer, and Emily B. Falk. (2016). Playful backstalking and serious impression management: How young adults reflect on their past identities on Facebook. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16)*, 1475-1487.
  36. David J. Shernoff, Mihaly Csikszentmihalyi, Barbara Schneider, and Elisa Steele Shernoff. 2003. Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly* 18, 2: 158-176.
  37. David J. Shernoff and Mihaly Csikszentmihalyi. 2009. Cultivating engaged learners and optimal learning environments. In *Handbook of positive psychology in schools*, Michael. J. Furlong, Richard. Gilman, and E. Scott (eds.). New York: Routledge, 131-145.
  38. Anya Skatova, Ben Bedwell, Victoria Shipp, Yitong Huang, Alexandra Young, Tom Rodden, and Emma Bertenshaw. 2016. The role of ICT in office work breaks. In *Proceedings of the 34th Annual ACM Conference on Human Factors in Computing Systems (CHI '16)*, 3049-3060.
  39. Wallis, C. (27 March, 2006). genM: The multitasking generation. *Time*. Retrieved September 16, 2017 from <http://content.time.com/time/magazine/article/0,9171,1174696,00.html>
  40. Yiran Wang, Melissa Niiya, Gloria Mark, Stephanie M. Reich, and Mark Warschauer. 2015. Coming of age (digitally): An ecological view of social media use among college students. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*, 571-582.
  41. Eileen Wood, Lucia Zivcakova, Petrice Gentile, Karin Archer, Domenica De Pasquale, and Amanda Nosko. 2012. Examining the impact of off-task multi-tasking with technology on real-time classroom learning. *Computers & Education* 58, 1: 365-374.