

# The Wired Generation: Academic and Social Outcomes of Electronic Media Use Among University Students

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## Abstract

Little is known about the influence of electronic media use on the academic and social lives of university students. Using time-diary and survey data, we explore the use of various types of electronic media among first-year students. Time-diary results suggest that the majority of students use electronic media to multitask. Robust regression results indicate a negative relationship between the use of various types of electronic media and first-semester grades. In addition, we find a positive association between social-networking-site use, cellular-phone communication, and face-to-face social interaction.

## Introduction

**D**UBBED "GENERATION NEXT" by the Pew Research Center, the current college student population is more digitally active than any previous generation.<sup>1-3</sup> Electronic media use includes e-mail, instant messaging (IM), cellular-phone communication, social-networking sites (SNSs), video or online games, and television or movie viewing. Due to its widespread use and dynamic nature, electronic media use deserves further attention in the literature. We focus our study on its influence in two spheres of college life: academics and social interaction.

## Background

### *Electronic media and academic performance*

Recent studies indicate a negative association between academic outcomes and the use of video games, SNSs, and other types of electronic media.<sup>4-9</sup> For example, Levine et al. found that students who IM more than others show more distractibility during academic tasks.<sup>10</sup> Bowman et al., in an experiment regarding multitasking, found that students took longer to read a passage if they were IMing at the same time; but IMing did not affect comprehension relative to students that read without IMing.<sup>11</sup>

Previous studies about the influence of electronic media on academic life have been problematic for two reasons. First, researchers have measured electronic media use with "stylized measurements" of time.<sup>12</sup> Stylized measurements estimate time spent in a particular activity during a typical period of time, like hours spent watching TV during a "typical day," or a longer period of time such as the previous

semester.<sup>13-15</sup> Initially, stylized measurements were appropriate in studies of electronic media because the technology was still emerging. Such measurements made it easy to distinguish between time spent using and not using electronic media. Measuring media use today requires more precision than stylized measurements can provide. A more accurate tool for measuring electronic media exposure is a time diary.<sup>16</sup>

Second, previous studies have conceptualized electronic media as a filler for "unstructured time," a leisure activity occupying time not filled with organized activities such as class, work, and so on.<sup>13,17</sup> These studies have disregarded the function of electronic media in multitasking.<sup>18-20</sup> College students and adolescents use electronic media simultaneously with other media (e.g., checking Facebook while IMing) or during activities requiring more focused attention, like class. Thus, indicators should allow for simultaneous use. The challenge is to study the academic influence of using SNSs independent of the influence of concurrent e-mail use. This challenge is intensified because technological innovations are constantly being popularized, especially among college students. It is increasingly more difficult to distinguish between various types of media use in order to estimate associations with academic performance. To address these measurement issues, we utilize time-diary data that allow for the indication of simultaneous electronic use.

Several background factors should be accounted for in analyzing the relationship between electronic media and academic performance. In general, males, ethnic minorities, and students who are employed during school have significantly lower college grades than their counterparts.<sup>21-23</sup> Previous performance measures should also be included.<sup>24,25</sup>

Considering these findings, we model the relationship between several types of electronic media exposure and academic achievement while controlling for other time use and student characteristics.

### *Electronic media and face-to-face interaction*

Prior research indicates that online communication with offline friends and family is associated with stronger offline relationships.<sup>26–29</sup> However, little attention has been paid to the trade-off between online and offline interaction in the recent literature. Most studies have used relationship strength, networks, or group participation as measurements of social interaction.<sup>29,30</sup> Electronic media use may result in a displacement effect due to its function as a filler for open time.<sup>17</sup> For example, time spent watching TV could replace time spent going out with friends because both are used to fill unstructured time.<sup>13</sup> To test accurately the extent to which computer-mediated communication either displaces or facilitates offline interaction, in-depth time-diary instruments are needed.

In discussing the consequences of electronic media on social interaction, most studies refer specifically to computer-mediated communication. Traditionally, this has included e-mail, IM, and chat. Recent studies have also included SNSs and text messaging.<sup>31</sup> Other forms of electronic media may also influence student social life. One study found that video-game use among college students was associated with lower relationship quality with friends and parents.<sup>32</sup> Others have found both positive and negative social outcomes associated with television viewing.<sup>16,33</sup>

Various background factors influence social participation and related outcomes. Among adolescents, social anxiety decreases with age and is more prevalent in females.<sup>34</sup> Ethnic minorities feel less positive rapport with their peers than do their counterparts.<sup>35</sup> These characteristics should be accounted for when modeling the relationship between electronic media and offline interaction.

Based on these findings, we utilize time-diary data to explore the relationship between electronic media exposure and student grades, as well as offline interaction, while controlling for other time use and student characteristics. Our first hypothesis is that electronic use is negatively associated with grades due to its distractive function. Second, we hypothesize that the relationship between electronic media use and face-to-face interaction is negative, providing support for a displacement effect between electronic media use and offline interaction. However, if the relationship is positive, electronic media use may facilitate offline interaction.

## **Method**

### *Sample*

Responses from first-year students were obtained through an Internet survey using Qualtrics online survey software. The survey included a questionnaire and 3-day log for recording activities in which students were engaged. It was distributed to all entry-level and transfer students in their first year at a private university in a western state. The university enrolls approximately 30,000 day students each semester.

In June 2008, we received IRB approval and access to first-year student e-mail lists. Pre-approved fliers notifying students of the study were posted in main lobby areas of campus

dormitories. These fliers also notified students of incentives (gift cards to campus stores) offered for their participation. Students were informed that participation was voluntary and information they provided would be kept confidential.

In constructing the time diaries, we considered the various functions of electronic media use. Regarding its use as an “empty” time filler, we assumed that the free time college students have occurs throughout varying parts of the day and week. Therefore, we allowed participants to select 3 days, including 2 weekdays and a weekend day, during a 3-week period to complete the diaries. We also took into account student multitasking capabilities. For each half-hour period per 24-hour day, students had the option of selecting between one and three activities (e.g., primary, secondary, and other) out of a list of 44, including both online and offline, structured and unstructured activities. Pilot surveys helped to enhance instrument validity.

Options entered in the logs included the following: adding to or reading blogs, weekly campus forum, in class, cleaning apartment, club meeting or activity, eating or preparing food, e-mail, exercise or sports, Facebook, hall or floor meeting or activity, hanging out, homework/study alone, homework/study with others, IM/chat, on a date, online game, online or offline shopping, pleasure reading, religious meeting or activity, religious study, shower/prepare for day or bed, sleeping, talking on a cell phone or text messaging, taking an exam, traveling, TV or movies, video games, volunteer work or service, employment, other online activity, and other offline activity. The option none was also included for secondary and other activities. Respondents were asked to specify other online and offline activities not included in the list.

We sent invitation e-mails to approximately 5,900 entry-level and transfer students who were in their first semester during the 2008/09 academic year.<sup>19</sup> At the conclusion of the semester, a follow-up survey requesting semester GPA was sent out. Overall, approximately 1,000 invitation e-mails were returned undeliverable. Of those who received the e-mails, 2,996 students participated, with 1,193 completing time logs for all 3 days. In addition, 167 cases were dropped because of missing GPA data. Therefore, we limit our sample to 1,026 first-year university students. Our sample includes more women students (65% compared to 53%), slightly more international students (6% compared to 4%), and fewer transfer students (8% compared to 18%) than the first-year population. With the exception of gender and transfer status, based on comparisons with university enrollment data, our sample is representative of the first-year student population.

### *Model specifications*

In our first model, the dependent variable, academic performance, is measured by self-reported GPA based on a scale from 0 to 4. Self-reported grades give a close approximation of actual grades.<sup>36</sup> In our second model, the dependent variable is social interaction offline, measured using time-diary data. Responses including hanging out, on a date, club meeting or activity, hall or floor meeting or activity, and other face-to-face social interactions (excluding academic, religious, and work-related activities) were grouped into a single variable measured in hours per day.

Measures of electronic media use were also derived from the time diaries. Seven variables, measured in average hours

per day, were constructed for the following electronic activities: SNSs, e-mail, chat/IM, cellular-phone communication or text messaging, video or online games, TV or movies (either online or offline), or some other online activity excluding those related to personal needs (e.g., online shopping), religion, academics, and employment.

Additional control measures of time use consisted of either online or offline activities having to do with academics (e.g., class, homework/study, taking exams, or other school-related activities). Each of these variables is measured in hours per day. Demographic controls include age, gender, race, and marital status. Age is measured in years and gender is coded as 0 (male) and 1 (female). Race is coded as 0 (non-white) and 1 (white). Marital status is coded as 0 (ever married) and 1 (never married).

Additional controls include international and residential status variables measured as dummy variables. Credit hours measure the total number of credit hours enrolled during fall semester 2008. Transfer status is a dichotomous measure indicating whether the student began the semester with transfer credit from another college or university (coded 1 if yes). ACT scores are standardized admissions scores ranging from 1 to 36. Employment status is coded as 0 (not working during the semester) or 1 (working during the semester).

#### Estimation procedure

Using Stata 10, we employ multiple imputation to account for variables with missing data and we estimate our models using OLS regression techniques.<sup>37</sup> The control variable with the most missing values (10%) was ACT score. All other variables were missing 1% or fewer cases. In testing the basic assumptions of OLS regression, we found evidence of influential observations in both models. The presence of outliers may influence the slope coefficients, as well as increases the risk of violation of other OLS assumptions.<sup>38,39</sup> To account for these violations and avoid biasing the slopes, we exercise robust regression techniques.<sup>39,40</sup> Robust regression is designed to down weight the most influential observations in the model and thus avoid biases related to outliers and nonnormality of residuals. Specifically, we use M estimation, a type of robust regression intended to down weight influential observations in the dependent variable while excluding highly influential outliers from the analysis.<sup>39-41</sup>

The coefficients or slopes represent the expected change in GPA (Table 3) or social interaction (Table 4) with each 1-hour increase in a specific electronic medium. Both online and offline time-diary variables are included in Model 1 of Tables 3 and 4. Student characteristics are added in Model 2 of both tables. Before the multivariate analysis, descriptive statistics are presented.

## Results

Descriptive statistics are presented in Table 1. About two-thirds of the sample was female, and the average age was about 19 years. The majority of the students were white, single, and living on campus. Approximately 40% of the students were employed during the semester and on average were enrolled in about 14 credits. The mean ACT score reported was 27.5, comparable to averages reported by university admissions. Our outcome measures indicate that the average fall semester GPA for the sample was 3.28, and stu-

TABLE 1. DESCRIPTIVE STATISTICS, STUDENT CHARACTERISTICS, AND ACADEMIC PERFORMANCE ( $N = 1,026$ )

Variables	M	SD	Min	Max
<i>Dependent variables</i>				
Fall semester GPA	3.28	0.64	0	4.00
Face-to-face social interaction	2.76	2.09	0	13.33
<i>Electronic media</i>				
Online social networks	0.86	1.02	0	8.83
E-mail	0.59	0.51	0	4.17
Chatting/IM	0.16	0.46	0	4.00
Cell phone/texting	0.74	1.29	0	12.00
Video/online games	0.16	0.54	0	6.17
TV/movie	0.86	1.01	0	6.83
Other online activity	0.27	0.68	0	6.83
<i>Other time use</i>				
Academic	5.24	2.26	0	19.50
Other	2.25	1.65	0	12.67
<i>Demographics</i>				
Female	0.65	0.48	0	1.00
Age	18.54	1.24	17	24.00
Single	0.98	0.14	0	1.00
White	0.88	0.33	0	1.00
International student	0.06	0.24	0	1.00
On-campus housing	0.64	0.48	0	1.00
<i>Education and employment</i>				
Number of credit hours	14.38	1.76	0	21.00
Transfer student	0.08	0.27	0	1.00
ACT score	27.57	3.32	15	35.00
Employed	0.40	0.49	0	1.00

dents reported an average of 2 hours and 46 minutes per day participating in offline social interaction.

Means and standard deviations for both online and offline time-diary variables are also reported in Table 1. On average, students spent approximately 52 minutes per day using SNSs (usually Facebook). Students reported that daily they spent on average just over half an hour e-mailing, about 10 minutes chatting or IMing, nearly 45 minutes talking on a cellular phone or text messaging, about 10 minutes playing video or online games, and close to an hour watching TV or movies. In addition, students spend almost 5.5 hours per day in class, studying, or in other academic activities.

Table 2 presents additional findings from the time diaries. Nearly all respondents own a cellular phone, and the majority have Internet access through a laptop or some other portable device. The average number of contacts students have among their "Facebook Friends" is between 151 and 200, and the average number of text messages students sent per day is

TABLE 2. ADDITIONAL RESULTS OF TIME-DIARY DATA ( $N = 1,026$ )

Variables	Median or Percent
Owns a cellular phone	96%
Internet access through a laptop or portable device	80%
Facebook friends	151 to 200
Text messages sent per day	11 to 20
Respondents who reported multitasking	62%

TABLE 3. UNSTANDARDIZED COEFFICIENTS FOR ROBUST REGRESSION OF GPA ON FIRST-YEAR STUDENT TIME USE AND OTHER CHARACTERISTICS

Variables	Model 1	Model 2
<i>Electronic media</i>		
Social-networking sites	-0.065***	-0.084***
Cell phone/texting	-0.046***	-0.039***
Video/online games	-0.071*	-0.084**
TV/movie	-0.061***	-0.046**
E-mail	0.049	0.064*
Chatting/IM	0.009	-0.003
Other online activity	0.005	-0.014
<i>Other time use</i>		
Academic	0.043***	0.029***
Social face-to-face	0.006	-0.017*
Other	0.019	0.007
<i>Demographics</i>		
Female	—	0.003
Age	—	0.026
Single	—	0.247*
White	—	0.051
International student	—	0.080
On-campus housing	—	0.072*
<i>Education and employment</i>		
Number of credits	—	0.015
Transfer student	—	0.026
ACT score	—	0.057***
Employed	—	-0.192***
R <sup>2</sup>	0.063	0.216
N	1,026	1,026

Note: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

between 11 and 20. A particularly important finding related to multitasking is that 62% of the respondents report using some kind of nonacademic electronic media while in class, studying, or doing homework.

Unstandardized regression coefficients describing the relationship between electronic media exposure and academic performance are presented in Table 3. Model 1 indicates that time-use variables alone account for about 6% of the variance in GPA. There is a significant negative association between SNS exposure and academic performance, controlling for offline time use. Cellular-phone communication has a similar affect. Video and online gaming, as well as TV and movies, also have inverse relationships with GPA. For every hour of electronic media exposure reported by students on average, GPA was reduced between 0.05 and 0.07 points. Contrary to prior research, chatting/IMing is not significantly associated with GPA.<sup>8</sup>

Model 2 indicates that after controlling for educational and employment characteristics there remains a significant relationship between the various types of electronic media use and academic achievement. SNS use, cellular-phone communication, video and online gaming, as well as TV and movie exposure, are negatively related to GPA. When adjusting for the effects of background characteristics, e-mail use is positively associated with GPA. Even after controlling for previous performance, time spent in academic activities has a significant positive association with GPA (each hour on average is associated with 0.03 GPA increase). When con-

TABLE 4. UNSTANDARDIZED COEFFICIENTS FOR ROBUST REGRESSION OF FACE-TO-FACE SOCIAL INTERACTION ON TIME USE AND OTHER CHARACTERISTICS

Variables	Model 1	Model 2
<i>Electronic media</i>		
Social-networking sites	0.236***	0.137*
Cell phone/texting	0.221***	0.191***
Video/online games	0.219	0.141
TV/movie	-0.004	0.003
E-mail	-0.153	-0.093
Chatting/IM	-0.233	-0.144
Other online activity	-0.169	-0.136
<i>Other time use</i>		
Academic	0.015	-0.014
Other	0.015	-0.002
<i>Demographics</i>		
Female	—	-0.029
Age	—	0.026
Single	—	0.421
White	—	0.667**
International student	—	-0.329
On-campus housing	—	0.448**
<i>Education and employment</i>		
First-semester GPA	—	-0.160
Number of credits	—	0.041
Transfer student	—	-0.314
ACT score	—	0.042
Employed	—	-0.540***
R <sup>2</sup>	0.034	0.098
N	1,026	1,026

Note: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

trolling for background characteristics, offline social interaction has a negative association with GPA (0.02 GPA decrease for every hour on average). Age and ACT score are positively associated with GPA, while employment is negatively associated with GPA. Explanatory variables account for about 22% of the variance.

The association between various types of electronic media exposure and offline social interaction is presented in Table 4. Model 1 lists unstandardized coefficients for the relationship between electronic media exposure measures and other time-use factors without controlling for student characteristics. These findings indicate a significant positive association between SNS exposure and social interaction. There is also a positive relationship between cellular-phone communication and social interaction. For every hour increase on average in SNS exposure or cell-phone communication, average face-to-face social interaction increased about 10 to 15 minutes. About 3% of the variance is accounted for by these variables. No other types of media exposure in this model significantly predict offline social interaction.

Further evidence that a displacement effect between social networking online and face-to-face interaction does not occur is found in Model 2. Based on these results, we note that even after controlling for academic and employment characteristics, the positive relationship between SNS exposure and social interaction, although somewhat smaller, still holds. This is also true for the relationship between cellular-phone communication and offline interaction. Race, housing accommo-

dations, and employment are also significant predictors of time spent offline in social interaction. Explanatory variables account for about 10% of the variance in face-to-face interaction.

### Discussion

Supportive of our hypothesis and consistent with prior research, our findings indicate that electronic media use is negatively associated with grades.<sup>7,9</sup> We also find that about two-thirds of the students reported using electronic media while in class, studying, or doing homework. This multitasking likely increased distraction, something prior research has shown to be detrimental to student performance.<sup>4</sup>

Concurrent with past studies that find that online communication is linked to time spent in offline relationships, our findings indicate that SNS use and cellular-phone communication facilitate offline social interaction, rather than replace it.<sup>26-29</sup> There are several explanations for this phenomenon. First, students are multitasking, and are likely sending and receiving text messages or checking SNSs while hanging out with friends. In addition, students are likely using cellular-phone communication and SNSs to make plans with friends to go on dates, hang out, or socialize. Finally, access to SNSs and cellular-phone communication gives students greater access to social situations in general. They provide students with additional mechanisms for meeting new people and keeping in touch with friends.

Although the use of time logs allowed us to consider more detailed measures of electronic media exposure, we still have data limitations. Due to a large number of undeliverable e-mails and the extensive structure of the time logs, we had a relatively low response rate (approx. 20% of all first-year students). Nevertheless, our sample is generally representative of the first-year student body. Another limitation is that in analyzing the students' time-diary responses for the "other" activity option, we noted that a large portion was related to music, suggesting it may also be considered a multitasking activity. Future research should examine the role of listening to music, as well as innovations such as Twitter. Despite these limitations, our findings on electronic media use among college students generally concur with findings from other universities in the United States.<sup>3</sup> Our findings provide a detailed perspective of electronic media use among university students and underscore that such use can produce both positive and negative consequences. It can distract from academic success, and at the same time facilitate social interaction and the development of social networks.

### Disclosure Statement

No competing financial interests exist.

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