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Technology and interactive social media use among 8th and 10th graders in the U.S. and associations with homework and school grades

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Abstract

This study examined differences by age, gender, and race/ethnicity in the use of technology and interactive social media from 2013–2016 using data from nationally-representative samples of U.S. 8th and 10th graders ($N=40,389$). Results indicated that 8th graders watch TV and play video games more than 10th graders; boys play more video games and use interactive social media less than girls; and Black adolescents use most forms of media more often than those from other race/ethnicity groups, with the exception of using the computer for school reported most often by Asian adolescents. Mean differences showed that adolescents who spend more time on homework spend more time using the computer for school, and spend less time watching weekday TV, playing video games, and talking on the phone. Adolescents with higher grades spend more time using the computer for school and spend less time on all other types of technology and interactive social media, except for watching weekend TV. Multivariable logistic regression results indicate that watching TV on a weekday was consistently negatively associated with academic outcomes and using the computer for school was consistently positively associated with academic outcomes.

Keywords

television; technology; social media; grades; homework; adolescence

1. Introduction

Over the last decade, technology and interactive social media have proliferated and become pervasive aspects of daily life (Valkenburg & Peter, 2013). Presently individuals are exposed to an unprecedented amount of media content, and this media content can be accessed across a variety of platforms including televisions, computers, cell phones, video games and newer types of interactive social media such as Facebook, Twitter, and Instagram. Children and teenagers are particularly heavy media users (Rideout, Foehr, & Roberts, 2010). A report by

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the Kaiser Foundation based on data collected in 2009, for example, indicates that using media is the leading waking activity among children and teenagers; adolescents spend about 8 hours a day using media, and when accounting for media multitasking, they are exposed to an average of 11 hours of media content each day (Rideout et al., 2010; Strasburger, Jordan, & Donnerstein, 2010). Consequently, there has been growing concern regarding the effects of technology and interactive social media use on children's development, namely their school outcomes. This concern is largely based on the displacement hypothesis, which posits that youth's high levels of media use may displace time spent in more productive educational activities such as doing homework and engaging in cognitively stimulating learning activities (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Sharif & Sargent, 2006; Wiecha et al., 2001). To date, most of the research in this area focuses on how only one or two technology and interactive social media types relate to young adolescents' academic outcomes giving an incomplete picture of how the current technological landscape relates to student outcomes. In addition, studies that have examined a wider range of technology and interactive social media rarely examine young adolescents' use in conjunction with a comprehensive set of individual and contextual factors. Given that individuals are embedded within multiple contexts and an individual's outcomes are due to a confluence of individual characteristics and factors within their environmental milieu (Bronfenbrenner & Morris, 1998), it is important to examine these associations with a comprehensive set of individual and contextual factors to help clarify the associations between technology and interactive social media use and academic outcomes.

1.1 Traditional Media and Academic Outcomes

1.1.1 Television—To date, most of the research on media use and academic outcomes focuses on traditional types of media platforms such as, television, computers, and video games. Study findings indicate that children and adolescents who watch high amounts of television, in the short term, generally spend less time engaged in cognitively stimulating activities such as reading and doing homework, and in the long term, tend to have lower grades and lower levels of educational attainment in early adulthood (Anderson et al., 2001; Hancox, Milne, & Poulton, 2005; Sharif & Sargent, 2010; Wiecha, Sobol, Peterson, 2001). For example, young adolescents who watch three or more hours per day of television are twice as likely not to have a college degree in comparison to their counterparts who watch less than an hour of television per day (Johnson, Cohen, Kasen, & Brook, 2007).

Few studies on television viewing, however, distinguish between time spent watching television on the weekend versus weekdays, which may have differential associations with students' school-related outcomes. Based on displacement theory, weekday (i.e., school-night) television watching could displace time spent doing homework and relate negatively to grades in school, although weekend (i.e., non-school night) television watching would be less likely to do so. Indeed, a longitudinal study of 10th graders found that watching television on the weekday predicted lower math achievement for students in 12th grade (Dumais, 2008), and a cross-sectional study of middle school (5th–8th) students found that weekday—but not weekend—television watching was related to lower school performance (Sharif & Sargent, 2006). Both of these studies highlight the importance of differentiating

when television was watched to get a better understanding of how it relates to students' academic performance.

1.1.2 Computers—In contrast to television, the research on computers and adolescents' academic outcomes suggests overall positive associations. In a nationally-representative sample of 12–16 year olds, for example, Fairlie and colleagues (2010) found that having a computer at home was positively related to students' achievement over time even after controlling for individual- and family-level characteristics. This pattern was echoed by a cross-sectional study of 13-year-olds in the U.S. and in Japan indicating a positive association between computer use at home and at school and science achievement (House, 2010). These findings are not surprising given that computers are often used to facilitate completing school work (Jackson et al., 2006; Subrahmanyam, Kraut, Greenfield & Gross, 2000). Moreover, unlike watching television, using computers generally requires input from the user and thus provides more opportunities for improving academic skills. Indeed, there is some evidence from cross-sectional studies on young children and longitudinal studies on adolescents to suggest that tasks performed on the computer may have spillover effects and can improve students' reading and problem solving skills (Jackson et al. 2006; Judge, 2005; Li & Atkins, 2004). These findings, however, are based on data from about a decade ago and it is unclear whether the association between computer use and school outcomes has remained consistent given the rapid changes in technology.

A longitudinal study of two cohorts by Dumais (2008), for example, found that computer use was related to higher math achievement for 10th graders in the 1990s but was unrelated to the achievement for 10th graders in the 2000s, even after controlling for sociodemographic factors (e.g., child gender, race/ethnicity, socioeconomic status). Thus, these findings indicate the importance of investigating the associations of computer use with school outcomes using contemporary data.

1.1.3 Video games—The evidence regarding the effects of video games on students' academic outcomes are mixed as well. Overall, studies suggest that playing video games can enhance cognitive skills, including visual spatial ability and problem solving skills, of students across a wide range of ages (for a review, see Subrahmanyam, Greenfield, Kraut, & Gross, 2001). However, more recent studies focused primarily on high school students suggest that playing video games is negatively associated with grades and test scores (Dumais, 2008; Jaruratanasirikul, Wongwaitawewong, & Sangsupawanich, 2009). The increases in media use during early and mid-adolescence (11–14 year olds) from childhood are due largely to increased time spent watching television and playing video games (Rideout et al., 2010), so it is particularly important to document the extent to which these activities relate to adolescents' school-related outcomes.

1.1.4 Interactive social media—Most of the research that examines the association between interactive social media and academic outcomes are based on college students, and study results demonstrate inconsistent associations with academic-related outcomes. Studies that have investigated cell phone use, texting, and instant messaging among college students indicate that talking on the phone and messaging are negatively correlated with homework completion and GPA (Fox, Rosen, & Crawford, 2009; Harman & Sato, 2011; Jacobsen &

Forste, 2011; Junco & Cotton, 2011). Similarly, more frequent use of social media, such as Facebook, by college students is associated with less studying and lower GPAs (Al-Menayes, 2015; Kirschner & Karpinski, 2010). In other work, use of interactive social media is unrelated to GPA or cognitive engagement in school work for college students (Pasek, More, & Hargittai, 2009; Turner & Croucher, 2014).

A review of extant literature concludes that few studies have examined the association between use of interactive social media (e.g., social networking sites) and young adolescents' outcomes (Best, Manktelow, & Taylor, 2014), with even fewer focused on academic outcomes. An ethnographic study of high school and college students suggests a positive association between use of social networking websites and adolescents' school-related outcomes; that is, social networking websites may support student learning because they provide a way for students to collaborate and work on projects together (Boyd, 2008). Understanding the extent to which the use of interactive social media relates to the academic outcomes of adolescents not yet in college is important to examine given the limited empirical research on this age group using contemporary data.

1.2 Age Differences

To date, most of the research on television and video games has focused on young children, while the majority of studies on interactive social media focus on college students. The limited research on the effects of technology and interactive social media for adolescents is of concern given that the early teen years (ages 11–14) marks a considerable increase in their media use (Rideout et al., 2010). Moreover, the associations between media use and school outcomes in the transition from middle school to high school may be particularly important to understand because this marks the time when social media platforms allow youth (at age 13) to create their own accounts, and when academic performance has implications for their future academic trajectory (Pike & Saupe, 2002). Thus, it is likely that younger adolescents will spend more time with television and videogames and less time with interactive social media than older adolescents because of the age restrictions regarding use on social media platforms. In addition, many of the studies investigating the link between technology and media use and academic outcomes are based on either unrepresentative convenience samples of college students or young children, and generally only examine one or two types of technology or media platforms. Studies that have examined the relationship between multiple types of technology and interactive social media and youth outcomes, on the other hand, often aggregate associations across a wide range of ages and/or do not include a comprehensive set of covariates that may confound study results (Schmidt & Vandewater, 2008). The literature is not clear on whether the association between use of various types of technology and interactive social media and academic outcomes varies by age among adolescents.

1.3 Gender and Race/Ethnicity Differences

Prior literature also suggests differential use of technology and interactive social media by gender and race/ethnicity. Although there are typically no gender differences in the amount of time that adolescents spend watching television in nationally-representative studies (Hoffereth, 2010; Rideout et al., 2010), there is evidence demonstrating that females spend

more time than males talking and texting on the cell phone and interacting on social networks (Lenhart, 2015; Rideout et al., 2010). Males, on the other hand, generally spend more time than females playing video games. Additionally, there is evidence indicating that adolescent males spend more time on the computer for recreational purposes, while adolescent females spend more time on the computer for school (Hunley et al., 2005; Rideout et al., 2010). Whether these patterns remain consistent in contemporary national data is not clear.

The patterns of technology and interactive social media use across race/ethnicities are more consistent. Black and Hispanic youth spend more time than White youth watching television, using computers recreationally, talking and texting on the phone, and using social media (Rideout et al., 2010). Important to note is that although Black and Hispanic youth generally spend more time with technology and interactive social media, a smaller proportion of Black and Hispanic youth have access to computers compared to White youth (Rideout et al., 2010). Finally, prior studies have focused on the technology and interactive social media use of White, Black, and Hispanic youth. Little is known about Asian American youth's use of technology and interactive social media at a national level and how their use compares to other race/ethnic groups in the United States.

Although several studies have examined gender and racial/ethnic group differences in use of technology and interactive social media, fewer studies have examined whether the relationship between media use and academic outcomes is moderated by these factors. One study that examined gender as a moderator found that messaging and socializing online in 8th grade predicted lower test scores one year later for adolescent females, but not for males. In contrast, online gaming predicted lower test scores one year later for adolescent males but not for adolescent females (Chen & Fu, 2009). A study by Hoffereth (2010) using longitudinal national data found that both gender and race/ethnicity moderated the relationship between computer use and achievement for children aged 6–12. Specifically, increases in the amount of time using the computer for school work predicted higher reading achievement for Black males and higher math achievement for White females, but was unrelated to the achievement of White males and Black females. Additionally, increases in time spent playing video games predicted lower reading achievement among White females and math achievement among Black females, but did not significantly predict achievement for Black or White males. These nuances are important to examine, but to date, there is limited work using contemporary national data to examine whether age, gender, and race/ethnicity moderates the relationship between various types of technology and interactive social media and academic outcomes among adolescents.

1.4 Related Factors

Additional factors that may influence adolescents' academic outcomes include family socioeconomic background, school engagement, and substance use. For example, there is a strong body of literature demonstrating differences in student achievement by parent education (e.g., Davis-Kean, 2005; Magnuson, 2007; Tang, Davis-Kean, Chen, & Sexton, 2016). School engagement (e.g., enjoyment of school, participation in extracurricular activities) is associated with higher grades and motivation to do well in school (Eccles,

Barber, Stone, & Hunt, 2003; Samdal, Wold, & Bronis, 2010). In contrast, substance use is negatively associated with adolescents' academic outcomes (Bachman et al., 2008). Although these factors are not of primary interest in the present study, they are important to include in the model to control for potential bias and confounding in the association of interest between technology and interactive social media use and adolescents' school-related outcomes.

2. Current Study and Hypotheses

The goal of the present study is to address the gaps in the literature with contemporary population-based data collected in 2013 to 2016. Using nationally representative cohort samples of 8th and 10th graders in the U.S., the first goal of this study is to describe adolescents' use of a range of technology and interactive social media platforms. Given that individuals exist within multiple contexts and developmental outcomes are a result of individual's characteristics within those contextual environments (Bronfenbrenner & Morris, 1998), we examine adolescents' technology and interactive social media use by grade level (8th and 10th), gender (male and female), and race/ethnicity (Black, White, Hispanic, Asian, and Other). We hypothesize that 8th graders will spend more time than 10th graders using more traditional technology (watching television, playing video games) while 10th graders will spend more time using interactive social media than 8th graders, who at age 13 are just becoming age-eligible to sign up for social media accounts per the Children's Online Privacy Protection Act. We also expect that 10th graders will spend more time using computers for school because they are more likely to be assigned writing assignments than their younger counterparts. Following extant literature (e.g., Hunley et al., 2005; Lenhart, 2015; Rideout et al., 2010), we expect that female adolescents will spend more time using computers for school and using interactive social media while male adolescents will spend more time playing video games. Finally, we expect Black and Hispanic adolescents to use all types of technology and media more frequently than White adolescents, except for the use of the computer because White adolescents are more likely to have access to computers (Rideout et al., 2010). Given limited prior research on Asian American adolescents, we do not have any specific hypotheses about their use of technology and interactive social media at a national level.

Second, this study will investigate the extent to which various types of technology and media use relate to two types of academic outcomes: the amount of time that students spend on homework and school grades. Based on the theory of displacement of time spent on productive activities, we hypothesize that more time spent watching television and playing video games will be negatively associated with adolescents' academic outcomes (Dumais, 2008; Hancox et al., 2005; Sharif & Sargent, 2010; Wiecha et al., 2001), and more time using the computer for school will be positively associated with adolescents' academic outcomes because computer use will facilitate completion of school work (House, 2010; Jackson et al., 2006; Subrahmanyam et al., 2000). In contrast, per the displacement hypothesis, we hypothesize that more time spent using interactive social media will be negatively associated with adolescents' academic outcomes. Finally, we will examine whether these associations are moderated by gender, race/ethnicity, and grade in school.

3. Method

Data for this study were drawn from Monitoring the Future (MTF), an ongoing study that has been administering national cross-sectional surveys of 8th, 10th, and 12th graders since 1975, with the purpose of investigating trends in risky behaviors such as drinking and drug use, values, and attitudes (Miech, Johnston, O'Malley, Bachman, Schulenberg, & Patrick, 2017). The present study is based on cohorts of adolescents in 8th and 10th grade from 2013 – 2016 who answered questions related to their technology and interactive social media use. Analyses accounted for the complex multistage sample design, and were weighted to adjust for differential selection probabilities. Response rates for surveys from 2013 to 2016 for 8th and 10th graders ranged from 89–90% (Miech et al., 2017). The weighted sample is 47% male, 58% White, 16% Hispanic, 13% other race/ethnicity, 10% Black, and 5% Asian. About half of the adolescents in the sample (52%) were in 8th grade ($n= 21,040$; vs. $n= 19,349$ in 10th grade), and over half of the sample (63%) had at least one parent with a college degree or higher.

3.1 Measures

3.1.1 Television—The average number of hours spent watching television on an average weekday and separately the average weekend was reported by students using the following responses: 1= “None,” 2= “Half hour or less,” 3= “About one hour,” 4= “About two hours,” 5= “About 3 hours,” 6= “About four hours,” 7= “Five hours or more.” The number of hours spent watching television on an average weekend was reported by students using a slightly different response scale: 1= “None,” 2= “Half hour or less,” 3= “1–2 hours,” 4= “3–4 hours,” 5= “5–6 hours,” 6= “7–8 hours,” 7= “9+ hours.” For purposes of comparability across technology and interactive social media platforms, both weekday and weekend television variables were transformed into z-scores for the analyses.

3.1.2 Computer for school—Students reported the number of hours per week they spent “using a computer to do school work” using the following response options: 1= “None,” 2= “Less than 1 hour,” 3= “1–2 hours,” 4= “3–5 hours,” 5= “6–9 hours,” 6= “10–19 hours,” 7= “20–29 hours,” 8= “30–39 hours,” 9= “40 or more hours.” For purposes of comparability across technology and interactive social media platforms, this variable was transformed into z-scores for the analyses.

3.1.3 Video games—Students reported the number of hours per week they spent “playing electronic games on a computer, television, phone, or other device” using the following response options: 1= “None,” 2= “Less than 1 hour,” 3= “1–2 hours,” 4= “3–5 hours,” 5= “6–9 hours,” 6= “10–19 hours,” 7= “20–29 hours,” 8= “30–39 hours,” 9= “40 or more hours.” For purposes of comparability across technology and interactive social media platforms, this variable was transformed into z-scores for the analyses.

3.1.4 Types of interactive social media—Students reported the number of hours per week they spent “texting on a cell phone,” “talking on the cell phone,” “video chatting (Skype, etc.),” and “visiting social networking websites like Facebook, Twitter, Instagram, etc.” Response options for these items were: 1= “None,” 2= “Less than 1 hour,” 3= “1–2

hours,” 4= “3–5 hours,” 5= “6–9 hours,” 6= “10–19 hours,” 7= “20–29 hours,” 8= “30–39 hours,” 9= “40 or more.” For purposes of comparability across media platforms, these variables were transformed into z-scores for the analyses.

3.1.5 5+ Homework hours—Students were asked, “About how many hours do you spend in an average week on all of your homework including both in school and out of school?” Responses were on a 7 point scale: 1= “0 hours,” 2= “1–4 hours,” 3= “5–9 hours,” 4= “10–14 hours,” 5= “15–19 hours,” 6= “20–24 hours,” 7= “25 or more hours.” Answers were recoded as 1= spending 5 or more hours/week on homework versus 0= spending less than 5 hours/week on homework.

3.1.6 High grades—Students reported their average school grades for the current year using the following response options: 9= “A (93–100),” 8= “A– (90–92),” 7= “B+ (97–89),” 6= “B (83–86),” 5= “B– (80–82),” 4= “C+ (77–79),” 3= “C (73–76),” 2= “C– (70–72),” 1= “D (69 or below).” Responses were recoded into a dichotomous variable where 1 = average of A’s and B’s versus 0= average of C’s and D’s.

3.1.7 Demographics and control variables—Dichotomous indicators for adolescent gender (1= male vs. 0= female), grade in school (1= grade 8 vs. 0= grade 10), highest parent educational attainment (1= college degree or higher vs. 0= less than college degree), and race/ethnicity categories (Black, White (reference), Asian, Hispanic, and Other) were included as control variables in the logistic regression analyses.

Several controls were added to the model to account for other factors related to adolescents’ academic outcomes such as enjoying school, participation in extracurricular activities, and substance use. To measure adolescents’ enjoyment of school, adolescents were asked to report how often they enjoyed being in school over the past year on a 5-point scale ranging from 1= never to 5= almost always. A dichotomous indicator for enjoyment of school was created where 1 indicates the student reported enjoying school often or almost always. Adolescents reported the extent to which they participated in four types of activities during the school year (i.e., school newspaper or yearbook; music or other performing arts; athletic teams; other school clubs or activities”) using the following response options: 1= “Not At All,” 2= “Slight,” 3= “Moderate,” 4= “Considerable,” 5= “Great.” A variable representing their level of participation in extracurricular activities was created by summing all the activities adolescents reported engaging in to a “considerable” and “great extent.” To represent the two most common substances used by adolescents, three dichotomous variables indicating whether the adolescent used alcohol in the last 12 months (1= yes, 0= no), engaged in binge drinking (5 or more drinks) in the past two weeks (1= yes, 0= no), and used marijuana in the last 12 months (1= yes, 0= no) were included in the models as well.

3.2 Analytic Strategy

Descriptive analyses of all variables of interest were assessed using Stata 14 (StataCorp, 2015). Wald tests were conducted to examine mean differences in technology and interactive social media use by grade in school, gender, race/ethnicity, and the two academic outcomes of interest: time spent on homework (5+ hours per week spent on homework) and high

grades (average of A's and B's). Logistic regression analyses were used to predict the two school outcomes of interest in separate sets of models. Given that our primary goal for this manuscript is to understand the extent to which technology and interactive social media use predict adolescents' academic outcomes, all technology and interactive social media variables along with grade (to account for the two groups of students in the sample) were used to predict both outcomes in the first step of each model. In the second step, demographic and control variables were added to the model for each outcome because we wanted to investigate whether the technology and interactive social media variables remain significant predictors of academic outcomes even after including a comprehensive set of meaningful contextual factors (often excluded from other studies) that are related to our predictors and outcomes of interest. In the third step, interactions between the technology and interactive social media variables with grade in school, gender, and race/ethnicity were added to the models. All analyses incorporated probability weights that adjusted the sample for selection criteria and nonresponse, which allows for inferences to the population of interest, a nationally representative sample of all 8th and 10th graders in the United States between 2013 and 2016.

4. Results

Table 1 displays the weighted means, standard deviations, and ranges of all the variables in the present study. About 39% of the sample spent 5+ hours a week on homework, and the majority of the sample (79%) reported earning an average of A's and B's in the current year. On average, adolescents spent 1 to 2 hours watching television on a weekday ($M = 3.87$, $SD = 1.74$) and 3 to 6 hours watching television on a weekend ($M = 4.14$, $SD = 1.61$). On a weekly basis, they spent, on average, 1 to 5 hours on the computer for school ($M = 3.25$, $SD = 1.66$), and 3 to 9 hours playing video games ($M = 4.52$, $SD = 2.32$). For interactive social media, adolescents spent an average of 3 to 9 hours per week texting ($M = 4.54$, $SD = 2.46$), 1 to 5 hours per week talking on the phone ($M = 2.99$, $SD = 1.89$), 1 to 5 hours video chatting ($M = 2.43$, $SD = 1.96$), and 3 to 9 hours using social networking websites ($M = 4.26$, $SD = 2.46$).

4.1 Use of Technology and Interactive Social Media

Adolescents spent more time watching television on the weekend than on the weekday. About 84% watched an hour or more of television on a weekend while 75% of adolescents watched at least one hour of television on a weekday. The majority of the sample (66%) reported using the computer for school and playing video games (79%) for at least an hour a week. Similarly, most adolescents texted (76%) and visited social networking websites (72%) for at least one hour per week. In contrast, only 46% of adolescents talked on the phone and 32% video chatted an hour or more per week. Thus for interactive social media, adolescents spent more time of their time texting, playing video games, and visiting social networking sites than talking on the telephone or video chatting.

4.1.1 Patterns by grade in school and gender—Results from Wald tests (see Table 2) indicate that there were significant differences in adolescents' use of technology and media by grade in school and gender. Adolescents in 8th grade spent more time watching television

and playing video games than adolescents in 10th grade. In contrast, 10th grade adolescents spent more time than 8th grade adolescents using the computer for school, and using the phone to text and talk. There were no significant differences in the amount of time 8th and 10th graders spent video chatting or visiting social networking websites.

As expected, male adolescents spent more time playing video games and female adolescents spent more time using interactive social media (texting and talking on the phone, video chatting, visiting social networking websites) than their respective counterparts. Female adolescents also spent more time using the computer for school. There were no significant gender differences on the amount of television watched on a weekday, but female adolescents spent more time than their male counterparts watching television on the weekend.

4.1.2 Patterns by race/ethnicity—The results in Table 3 show that there were significant differences in technology and media use by race/ethnicity as well. On average, Black adolescents used all forms of technology and media, except for the computer for school, more often than adolescents of any other race/ethnicity. Although Black adolescents played video games more frequently than adolescents of most other race/ethnicities, Asian adolescents played video games at similarly high frequencies. In contrast, in comparison to all other race/ethnic groups, Asian adolescents generally spent the least amount of time using most forms of technology and media except for the computer for school and video chatting. Asian adolescents spent significantly more time using the computer for school than adolescents from any other race/ethnic group, and they spent significantly more time than White and Hispanic adolescents video chatting. Although Hispanic adolescents generally used technology and interactive social media at rates similar to White adolescents, they spent more time watching television, talking on the phone, and using social networking websites and less time using the computer for school than their White counterparts.

4.1.3 Patterns by academic outcomes—The results presented in Table 4 show that, on average, adolescents who spent 5+ hours on homework spent more time using the computer for school. In contrast, students who spent less than 5 hours a week on homework spent more time watching television on a weekday, playing video games, and talking on the phone. There were no significant differences in the amount of time adolescents spent on homework by the amount of time spent with interactive social media (texting, talking on the phone, video chatting, social networking).

A strong and consistent pattern of group differences in technology and interactive social media use emerged between adolescents with high and low grades. Adolescents who had high grades spent more time using the computer for school than their counterparts who had low grades. Conversely, students who had low grades spent more time on all other types of technology and interactive social media, except for watching television on the weekend.

4.2 Logistic Regression Analyses

A series of hierarchical logistic regression models were estimated for each school outcome of interest. In the first step, each outcome variable was regressed on all technology and interactive social media variables. In the second step, all demographic and control variables

were added to the model. For the model predicting high grades in school, the number of hours spent on homework also was added as a control. In step 3, interactions between the technology and interactive social media variables with grade in school, gender, and race/ethnicity were added to the model for both academic outcomes. Out of the 72 possible interactions run for each model, only 1 interaction was significant for each outcome. Therefore, only the main effects models for each outcome are presented in Table 5. Any significant differences between steps are noted below. Finally, due to the large sample of the present study, a more conservative threshold for significance ($p < 0.01$) was used in an effort to reduce potential Type II errors.

4.2.1 Predicting 5+ homework hours—Results demonstrate that a one standard deviation increase in watching television on the weekdays was associated with 29% lower odds of spending 5+ hours per week on homework, while a one standard deviation increase in watching television on the weekend was associated with 27% higher odds of spending 5+ hours on homework each week. Out of all the technology and interactive social media types examined in this study, using the computer for school was associated with the highest odds of spending 5+ hours on homework each week; a one standard deviation increase in time spent using the computer for school was associated with 90% higher odds of spending 5+ hours on homework each week. The association between interactive social media and time spent on homework, however, was inconsistent. Although a one standard deviation increase in texting on the phone was associated with 8% higher odds of spending 5+ hours on homework, a one standard deviation increase in video chatting was associated with 7% lower odds of spending 5+ hours on homework. Visiting social networking websites and talking on the phone were not associated with the time adolescents spent on homework each week. The only interaction term that significantly predicted 5+ homework hours was between playing video games and grade in school. For adolescents in grade 8, a one standard deviation increase from the mean of playing video games was associated with 9% lower odds of spending 5+ hours on homework. In contrast, for adolescents in grade 10, a one standard deviation increase in playing video games was associated with 6% higher odds of spending 5+ hours on homework.

Many of the control variables were significantly associated with homework hours. Adolescents who were in 8th grade, male, and Black had lower odds of spending 5+ hours on homework in comparison to adolescents in 10th grade, who were female, and White. In contrast, Asian adolescents and adolescents with parents with at least a college degree had higher odds of spending 5+ hours on their homework than White adolescents and adolescents with parents without a college degree. Adolescents who reported enjoying school and participating in extracurricular activities also had higher odds of spending 5+ hours on homework than adolescents who did not enjoy school and who did not participate in extracurricular activities. Although drinking alcohol and binge drinking were not related to adolescents spending 5+ hours on their homework, use of marijuana in the past year was associated with significantly lower odds of spending 5+ hours a week on homework in comparison to students who did not use marijuana in the past year.

4.2.2 Predicting high grades—Of all the technology and interactive social media types examined in this study, only use of the computer for school was associated with greater odds of having high grades; a one standard deviation increase in time spent using the computer for school was associated with 16% higher odds of having high grades. In contrast, watching television on the weekday, playing video games, and talking on the telephone were associated with significantly lower odds of having high grades. Specifically, watching television on the weekday was associated with 16% lower odds of having high grades followed by talking on the phone (11% lower odds), and playing video games (6% lower odds). Although watching television on the weekend was associated with higher odds of having high grades, and texting and video chatting were associated with lower odds of having high grades, all three became non-significantly associated with high grades once demographic and control variables and time spent on homework were added to the model. Similar to spending 5+ hours on homework, visiting social networking websites was not significantly related to adolescents' odds of having high grades. The only interaction term that significantly predicted high grades was between video chatting and being Hispanic (vs. White). For White adolescents, a one standard deviation increase in the mean of video chatting was associated with 11% lower odds of having a high grade whereas for Hispanic adolescents, a similar increase in video chatting was associated with 24% higher odds of having a high grade.

Demographic and control variables were strongly associated with adolescents' odds of having high grades as well. The odds of having high grades in school were higher for adolescents who were in 8th grade, female, and Asian in comparison to adolescents who were in 10th grade, male, and White. Similarly, the odds of having high grades were higher for adolescents with a parent with at least a college degree, who enjoyed school, and who participated in extracurricular activities. In contrast, binge drinking and using marijuana were associated with significantly lower odds of having high grades. Finally, each unit increase in spending 5+ hours on homework was associated with 27% higher odds of having high grades.

5. Discussion

The purpose of the present study was to investigate the extent to which use of technology and interactive social media relates to adolescents' academic outcomes, an age group and outcome domain that has received little attention from prior studies. The current study contributes to the current body of work in this area in a number of ways. First, due to the rapid changes in the technological environment (Lenhart, 2015) and evidence suggesting that the association between technology and adolescent outcomes can change over time (e.g., Dumais, 2008), this study examined whether the differences in use by age, gender, and race/ethnicity remains consistent in contemporary data. Second, few studies have examined technology and interactive social media use among Asian adolescents in the United States. This study is one of the first to do so and compare their use with other race/ethnicities using nationally representative data. Finally, in line with Bronfenbrenner's bioecological theory of development (Bronfenbrenner & Morris, 1998), this study used multivariable models that take individual characteristics and context into account to examine the relative importance of a range of technology and interactive social media use for the academic outcomes of 8th and

10th graders, who are among the highest users of technology and interactive social media among youth today (Rideout et al., 2010).

5.1 Trends in Use of Technology and Interactive Social Media

In general, the findings on technology and interactive social media use in this study are in accordance with results from other studies, and thus suggest that the technology and interactive social media use across groups has remained quite consistent over time. As hypothesized, younger adolescents spent more time using more traditional forms of technology, such as watching television and playing video games, while older adolescents spent more time using the computer for school. Contrary to expectations, older adolescents spent more time than younger adolescents using only certain forms of interactive social media, namely texting and talking on the phone. There were no differences by grade in the amount of time adolescents spent video chatting and visiting social network websites. The absence of significant grade differences in use of social networking websites is somewhat surprising given that age 13 (8th grade) is when most social networks allow youth to sign up for an account. These results may indicate that adolescents adopt newer interactive social media quickly or that youth are using social networking websites prior to age 13. Indeed, surveys of European children indicate that children under age 13 commonly use social networking websites despite the age restrictions on signing up for social networking accounts (Livingstone, Ólafsson, & Staksrud, 2013; Nominet, 2014). Although based on a convenience sample, another study of children in the U.S. found that most of the children in the sample reported signing up for their first social networking account by age 9 (Weeden, Cooke, McVey, 2013). Given the prevalence of underage use of social networking websites in the U.S. and abroad, it is important to examine the use of interactive social media at an earlier age to understand its influence on younger users.

Gender differences in technology and interactive social media use were also reflective of findings in other studies (Hunley et al., 2005; Lenhart, 2015; Rideout et al., 2010). As hypothesized, male adolescents spent more time playing video games while female adolescents spent more time with interactive social media and using the computer for school. The latter finding is consistent with research indicating that females spend more time on homework, in general (Leone & Richards, 1989; Xu, 2006). Unique to this study was the differentiation between watching television on the weekday versus the weekend. Although there were no gender differences in the amount of television watched during the weekday, female adolescents watched slightly more television on the weekend in comparison to male adolescents. With the current data, we are unable to explain why this difference exists, but it could be that weekend television shows are geared towards more towards the interest of adolescent females than adolescent males. Similarly, it could be that male and female adolescents spend a similar amount of time on the weekday watching television because there is less free time to do so after school and before bedtime. To test these hypotheses, however, it would be necessary to know the content of television shows that adolescents are watching or to have time diary data, for example, on what adolescents are doing between the end of the school day and before bedtime.

Use of technology and interactive social media by various race/ethnic groups also was consistent with group differences found in other studies. Except for playing video games and using the computer for school, Black adolescents used all forms of technology and interactive social media more often than adolescents of all other race/ethnicities. Following Black adolescents, Hispanic adolescents, on average, spent the most time watching television during the weekday, followed by adolescents in the Other race/ethnicity group and then White adolescents. Although Black and Asian adolescents played video games at similarly high frequencies, Asian adolescents spent the least amount of time watching television on the weekday and weekend, talking on the phone, and visiting social networking websites relative to all other race/ethnic groups. In contrast, Asian adolescents, on average, used the computer for school most often, followed by White adolescents, adolescents in the Other race/ethnicity group, and then Black adolescents. On average, Hispanic adolescents used the computer for school the least often, although this was not significantly different than the amount of time spent using the computer for school by Black adolescents. This trend echoes findings from other studies indicating that Black and Hispanic adolescents generally have less access to computers than adolescents of other race/ethnicities (Rideout et al., 2010), which may be an artifact of differences in families' socioeconomic statuses. In this sample, the racial/ethnic order of parents with a college degree or more (75% Asian families, 70% White families, 60% Other race/ethnicity, 58% Black families, and 31% Hispanic families) follow a similar order as adolescents' time spent using the computer for school, which supports the notion that use of computers for school is associated with adolescents' socioeconomic background. Thus, race/ethnicity per se does not cause an individual to use certain types of technology or interactive social media, but instead, race/ethnicity is a proxy for other factors correlated with the individual's social and environmental context that need to be investigated in future studies.

Finally, the results provided some support for the time displacement theory. Adolescents who spent more time watching television on the weekday and playing video games spent less time on their homework. Furthermore, students who spent more time using the computer for school spent more time on their homework and had higher grades. Students who had mostly low grades, however, used all other forms of technology and interactive social media more often than their counterparts who had mostly high grades. This hypothesis could be tested more rigorously in the future with a study that examined time tradeoffs using time diary data.

5.2 Association of Media Use with Academic Outcomes

Results from the multivariable logistic regression models provide a clearer understanding of the relative importance of each technology and interactive social media type on adolescents' academic outcomes. Watching television and using the computer for school were the two most consistent and strongest predictors of adolescents spending 5+ hours on homework and having high grades in school, albeit in opposite directions. Adolescents who watched more television during the weekdays had higher odds of spending less than five hours a week on homework and lower odds of having high grades. These results are similar to findings from multivariable analyses on younger children demonstrating that watching television before age 3 and in preschool was linked to lower cognitive performance (Zimmerman &

Christakis, 2005). Important to note, however, is that adolescents' time spent watching television on the weekends was not significantly related to having high school grades. This finding is consistent with a cross-sectional study of younger children (5th–8th graders) indicating that weekend screen time was not associated with school performance (Sharif & Sargent, 2006). Differentiating between watching television on the weekday versus the weekend is therefore important for understanding how technology and interactive social media are associated with adolescent academic outcomes.

The association between all other types of technology and interactive social media assessed in this study and adolescents' academic outcomes were inconsistent across academic outcomes. Playing video games was not associated with time spent on homework but was associated with lower odds of having high grades, the latter of which is consistent with other studies of high school students (Dumais, 2008; Jaruratanasirikul, Wongwaitawee Wong, & Sangsupawanich, 2009). Although there was a significant interaction between playing video games and grade in school and video chatting and being Hispanic (vs. White), these two interactions may have been an artifact of the large number of interactions that were run in the model. Thus, future work should examine whether these interactions are truly meaningful. Nonetheless, in general, the results from this study indicate that the forms of technology and interactive social media documented to increase in use the most among this age group (watching television and playing video games; Rideout et al., 2010) were associated with lower odds of having high grades. These results suggest that to support adolescents' academic outcomes, parents should monitor the amount of time that adolescents engage in these activities.

In contrast, use of interactive social media such as texting, talking on the phone, and video chatting were inconsistently associated with adolescents' academic outcomes. Texting was associated with higher odds of spending more time on homework, but video chatting was associated with lower odds of spending more time on homework. Talking on the phone was not significantly associated with time spent on homework but was associated with lower odds of having high grades. Surprisingly, visiting social networking websites was unrelated to either academic outcome. The lack of a significant association may be due to the wide variability in how adolescents use social networks (e.g., socializing with friends vs. working on group projects for school). Based on the present data, however, it is unclear why these forms of interactive social media had differential associations with adolescents' academic outcomes. One possible explanation of these differences is that some conversations may be productive and focused on school (e.g., how to do a homework problem) while other conversations may be unrelated to schoolwork (e.g., focused on making plans to see a movie), or undermine schoolwork (e.g., plan to skip class the next day). Additionally, some forms of interactive social media may be conducive to more productive conversations about schoolwork than others. There is extant work demonstrating that educational and age-appropriate content is associated with better cognitive and academic outcomes whereas content that is not age appropriate (e.g., adult content) is associated with poorer outcomes (Kostyrka-Allchorne, Cooper, & Simpson, 2017). Thus, these findings suggest that future studies should investigate the content of adolescents' conversations across interactive social media platforms and examine whether these have differential associations with school outcomes.

Finally, it is important to note, the demographic and control variables were more strongly and consistently associated with adolescents' academic outcomes than all the technology and interactive social media variables examined in this study. In particular, these study results indicate that adolescents' odds of having high grades were strongly associated with their race/ethnicity, parents' educational attainment, enjoyment of and engagement in school, and lack of recent binge drinking and marijuana use. That said, the relative importance of the associations between technology and interactive social media use and adolescents' academic outcomes is consistent with the small to moderate effect size of media on individual's outcomes found in prior studies (Valkenburg & Peter, 2013).

5.3 Limitations

There are four primary limitations that should be considered when interpreting the study results. First, this study was based on cross-sectional data, which makes it impossible to determine the direction of effects. Second, this study was unable to identify the mechanisms to explain why certain types of technology and interactive social media were positively or negatively associated with adolescents' academic outcomes. Information on the content of television programs, video games, and conversations on interactive social media could help provide some clarity on whether the negative associations, for example, are a result of time displacement or a result of exposure to unproductive and non-academic-related content. Third, this study does not include any measures of multitasking. Thus, use of and exposure to technology and interactive social media may be overestimated. Relatedly, this study examines the relative importance of each type of technology and interactive social media, but in reality adolescents use a variety in a given week. As a result, it would be interesting for future research to examine whether certain profiles of media use are associated differentially with academic outcomes. Finally, the data in this study are based on adolescent self-report, which may bias the results. In particular, it is unclear how accurately and reliably adolescents measure their use of technology and interactive social media (e.g., reporting texting in hours). Due to social desirability, respondents may have underestimated their technology and interactive social media use and/or overestimated their academic outcomes; this may have attenuated the associations between technology use and academic outcomes. Despite this limitation, other national studies also have relied on adolescents' report of their technology and interactive social media use (e.g., Rideout et al., 2010; Lenhart, 2015), and the use of technology and interactive social media reported in this study are consistent with those reported in other national studies.

5.4 Conclusions

Despite these limitations, this study contributes to the literature in several ways. Importantly, it is among one of the first studies to detail and compare the technology and interactive social media use of Asian American adolescents and compare it to the use of adolescents from other race/ethnicities. Study results demonstrate that in general Asian American adolescents use all types of technology and interactive social media, except for the computer for school and playing video games, at lower rates than adolescents of other racial/ethnic backgrounds. Second, this study demonstrates that despite the array of technology and interactive social media accessed by adolescents, watching television on the weekday is consistently associated with lower odds of spending 5+ hours on homework per week and

earning high grades. In contrast, using the computer for school is consistently associated with higher odds of spending 5+ hours on homework and earning high grades. Both of these associations remained even after controlling for important sociodemographic and individual factors.

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Highlights

- Boys play more video games and use interactive social media less than girls
- Black teens use most forms of media more than teens of other race/ethnicity groups
- Asian teens use the computer for school more often than other teens
- Teens who spend more time on almost all technology and media have lower grades
- Watching weekday tv is negatively associated with outcomes even with controls added

Table 1

Weighted Descriptives of Study Variables

	<i>M</i> or %	<i>SE</i>	<i>Range</i>	
			<i>Min</i>	<i>Max</i>
5+ Homework Hours	39.37%		0	1
High Grades (A's and B's)	78.95%		0	1
Television on a weekday	3.87	1.74	1	7
Television on a weekend	4.14	1.61	1	7
Computer for school	3.25	1.66	1	9
Play electronic video games	4.52	2.32	1	9
Texting	4.54	2.46	1	9
Talking on phone	2.99	1.89	1	9
Video chatting	2.43	1.96	1	9
Social networking	4.26	2.46	1	9
Grade 8	52.09%		0	1
Male	49.29%		0	1
Black	12.91%		0	1
White	49.84%		0	1
Asian	4.41%		0	1
Hispanic	19.65%		0	1
Other	13.19%		0	1
Parent Educational Attainment (College or More)	60.56%		0	1
Enjoy School	37.68%		0	1
Participate in Extracurriculars	1.05	0.98	0	4
Drink alcohol past year	30.82%		0	1
Binge drink last 2 weeks	7.81%		0	1
Smoke marijuana last year	18.74%		0	1

Note. The response scale for watching television on an average weekday was 1="None," 2="Half hour or less," 3="About one hour," 4="About two hours," 5="About 3 hours," 6="About four hours," 7="Five hours or more." The response scale for watching television on an average weekend was 1="None," 2="Half hour or less," 3="1–2 hours," 4="3–4 hours," 5="5–6 hours," 6="7–8 hours," 7="9+ hours." The response scale for time using a computer for school and playing video games per week was 1="None," 2="Less than 1 hour," 3="1–2 hours," 4="3–5 hours," 5="6–9 hours," 6="10–19 hours," 7="20–29 hours," 8="30–39 hours," 9="40 or more hours" per week. The response scale for time using interactive media per week were 1="None," 2="Less than 1 hour," 3="1–2 hours," 4="3–5 hours," 5="6–9 hours," 6="10–19 hours," 7="20–29 hours," 8="30–39 hours," 9="40 or more" per week.

Table 2
 Weighted Wald Tests of Technology and Media Use by School Grade and Gender

	Grade 8		Grade 10		Female		Male	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Television on a weekday	3.99	0.03	3.73	0.03	3.85	0.03	3.87	0.03
Television on a weekend	4.22	0.02	4.06	0.02	4.18	0.02	4.11	0.02
Computer for school	2.98	0.04	3.52	0.05	3.33	0.04	3.18	0.04
Play electronic video games	4.60	0.03	4.44	0.03	4.31	0.03	4.73	0.02
Texting	4.23	0.03	4.85	0.04	4.98	0.03	4.08	0.03
Talking on phone	2.89	0.03	3.09	0.03	3.18	0.03	2.77	0.02
Video chatting	2.48	0.03	2.40	0.03	2.52	0.02	2.33	0.02
Social networking	4.03	0.03	4.48	0.03	4.77	0.03	3.71	0.03

Note. Coefficients in bold indicate significant mean differences at $p < .01$ level. The response scale for watching television on an average weekday was 1=“None,” 2=“Half hour or less,” 3=“About one hour,” 4=“About two hours,” 5=“About 3 hours,” 6=“About four hours,” 7=“Five hours or more.” The response scale for watching television on an average weekend was 1=“None,” 2=“Half hour or less,” 3=“1–2 hours,” 4=“3–4 hours,” 5=“5–6 hours,” 6=“7–8 hours,” 7=“9+ hours.” The response scale for time using a computer for school and playing video games per week was 1=“None,” 2=“Less than 1 hour,” 3=“1–2 hours,” 4=“3–5 hours,” 5=“6–9 hours,” 6=“10–19 hours,” 7=“20–29 hours,” 8=“30–39 hours,” 9=“40 or more hours” per week. The response scale for time using interactive media per week were 1=“None,” 2=“Less than 1 hour,” 3=“1–2 hours,” 4=“3–5 hours,” 5=“6–9 hours,” 6=“10–19 hours,” 7=“20–29 hours,” 8=“30–39 hours,” 9=“40 or more” per week.

Table 3

Weighted Wald Tests of Technology and Media Use by Race/Ethnicity

	Black		White		Asian		Hispanic		Other	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Television on a weekday	4.60 ^{wa}	0.04	3.61 ^{ba}	0.02	3.14 ^{aw}	0.06	4.10 ^{ba}	0.03	3.99 ^{aw}	0.03
Television on a weekend	4.62 ^{wa}	0.03	4.05 ^{ba}	0.01	3.65 ^{aw}	0.06	4.16 ^{ba}	4.14	4.21 ^{aw}	0.03
Computer for school	3.03 ^{wa}	0.05	3.35 ^{ba}	0.04	4.07 ^{aw}	0.09	2.96 ^{ba}	0.05	3.19 ^{aw}	0.04
Play electronic video games	4.73 ^{wh}	0.05	4.42 ^{ba}	0.03	4.72 ^w	0.10	4.45 ^{bo}	0.04	4.69 ^{wh}	0.04
Texting	4.98 ^{wa}	0.07	4.47 ^{ba}	0.03	3.70 ^{aw}	0.08	4.55 ^{ba}	0.06	4.76 ^{aw}	0.05
Talking on phone	3.70 ^{wa}	0.06	2.83 ^{ba}	0.02	2.50 ^{aw}	0.05	2.94 ^{ba}	0.04	3.20 ^{aw}	0.04
Video Chatting	2.89 ^{wa}	0.06	2.30 ^{ba}	0.02	2.54 ^{aw}	0.06	2.32 ^{ba}	0.04	2.68 ^{aw}	0.04
Social networking	4.66 ^{wa}	0.06	4.12 ^{ba}	0.03	3.96 ^{aw}	0.09	4.32 ^{ba}	0.05	4.50 ^{wa}	0.06

Note. Superscript letters within each row indicate significant differences between race/ethnicity groups at $p < 0.01$.

^b indicates significant differences with Black, ^w indicates significant differences with White, ^a indicates significant differences with Asian, ^h indicates significant differences with Hispanic, and ^o indicates significant differences with Other. For example, Black adolescents, on average, watch more television on a weekday than adolescents of all other race/ethnicity groups (White, Asian, Hispanic, and Other).

Weighted Wald Tests of Technology and Media Use by Hours Spent on Homework and Average Grade

Table 4

	< 5 Homework Hours		5+ Homework Hours		Low Grades		High Grades	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Television on a weekday	4.03	0.02	3.58	0.03	4.18	0.03	3.76	0.02
Television on a weekend	4.15	0.02	4.13	0.02	4.21	0.03	4.12	0.02
Computer for school	2.80	0.03	3.94	0.05	2.85	0.04	3.36	0.04
Play electronic video games	4.57	0.02	4.43	0.04	4.81	0.02	4.45	0.02
Texting	4.54	0.03	4.54	0.03	4.91	0.04	4.45	0.03
Talking on phone	3.02	0.02	2.92	0.03	3.33	0.04	2.89	0.02
Video chatting	2.45	0.02	2.39	0.03	2.66	0.04	2.37	0.02
Social networking	4.27	0.03	4.24	0.03	4.65	0.04	4.16	0.03

Note. Coefficients in bold indicate significant mean differences at $p < .01$ level. The response scale for watching television on an average weekday was 1=“None,” 2=“Half hour or less,” 3=“About one hour,” 4=“About two hours,” 5=“About 3 hours,” 6=“About four hours,” 7=“Five hours or more.” The response scale for watching television on an average weekend was 1=“None,” 2=“Half hour or less,” 3=“1–2 hours,” 4=“3–4 hours,” 5=“5–6 hours,” 6=“7–8 hours,” 7=“9+ hours.” The response scale for using a computer for school and playing video games was 1=“None,” 2=“Less than 1 hour,” 3=“1–2 hours,” 4=“3–5 hours,” 5=“6–9 hours,” 6=“10–19 hours,” 7=“20–29 hours,” 8=“30–39 hours,” 9=“40 or more hours” per week. The response scale for all interactive media were 1=“None,” 2=“Less than 1 hour,” 3=“1–2 hours,” 4=“3–5 hours,” 5=“6–9 hours,” 6=“10–19 hours,” 7=“20–29 hours,” 8=“30–39 hours,” 9=“40 or more” per week.

Weighted multivariable logistic regressions predicting school outcomes for 8th and 10th graders

Table 5

	5+ Homework Hours			High Grades ²		
	AOR ¹	SE	p	AOR	SE	p
Technology and Interactive Social Media (z-scored)						
Watch television on a weekday	0.71	0.02	0.00	0.84	0.03	0.00
Watch television on a weekend	1.27	0.03	0.00	1.06	0.03	0.06
Use computer for school	1.89	0.05	0.00	1.16	0.03	0.00
Play electronic video games	0.97	0.02	0.13	0.94	0.02	0.00
Text	1.08	0.03	0.00	1.05	0.04	0.16
Talk on phone	0.98	0.02	0.41	0.89	0.03	0.00
Chat on video	0.93	0.02	0.00	0.94	0.02	0.02
Visit social networking websites	0.96	0.02	0.13	0.93	0.03	0.03
Demographics and Controls						
Grade 8 (vs. Grade 10)	0.68	0.04	0.00	1.45	0.10	0.00
Male (vs. Female)	0.83	0.03	0.00	0.63	0.03	0.00
Race/Ethnicity (vs. White)						
Black	0.54	0.04	0.00	0.65	0.06	0.00
Asian	1.30	0.10	0.00	1.82	0.32	0.00
Hispanic	0.87	0.06	0.04	0.74	0.05	0.00
Other	0.87	0.05	0.01	0.74	0.06	0.00
Parent Ed. Attainment (College+ vs. < College)	1.43	0.06	0.00	1.74	0.08	0.00
Enjoy School	1.26	0.04	0.00	1.91	0.09	0.00
Participate in Extracurricular Activities	1.14	0.02	0.00	1.54	0.04	0.00
Alcohol use past 12 months	0.93	0.04	0.13	0.94	0.05	0.29
Binge drink last 2 weeks	0.85	0.06	0.03	0.71	0.06	0.00
Marijuana use past 12 months	0.85	0.05	0.00	0.54	0.03	0.00
5+ Homework Hours (z-scored)				1.27	0.03	0.00
Constant	0.52	0.03	0.00	3.06	0.21	0.00
n	24693			24398		

	5+ Homework Hours			High Grades ²		
	AOR ¹	SE	p	AOR	SE	p
Goodness of Fit						
F-adjusted test statistic	F(9,642) =5.89			F(9,642) =0.90		
Prob > F	0.00			0.52		

Note.

¹ AOR = Adjusted odds ratio. Significance assessed at $p < .01$ level.

² Sensitivity analyses were conducted with different cutoff points for High Grades (i.e., A through B- vs. C+ through D and below; A through B- vs. B- through D and below; A and A- vs. B through D and below), but the pattern of results for technology and interactive media remained consistent. For clarity, the results presented here are based on High Grades defined as A's vs. C's and D's.