PRELIMINARY AND INCOMPLETE

The Effects of Computers on Cyberbullying and Social Participation among Schoolchildren: Evidence from a Field Experiment

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Abstract

Concerns over social and psychological problems stemming from children's computer use abound in the media and in forums for anecdotal evidence. Almost no research, however, provides plausibly causal evidence on this question. We provide the first such evidence on the social and psychological impacts of home computers by conducting a randomized control experiment with 1,123 students in grades 6-10 attending 15 schools across California. The experiment had a large effect on computer ownership and total hours of computer use. In the present study we find no evidence that computer ownership increases social isolation. In fact, computer ownership appears to increase social participation for some measures. Students in the treatment group report spending more time on computers for schoolwork and also more time on games, social networking and other entertainment. Students in the treatment group are more likely to report having an Internet connection and a social networking site but they nevertheless report spending more time communicating with and interacting with friends in real time. We also find no evidence that computer ownership displaces participation in after-school activities such as sports teams or clubs. We also do not find evidence that home computers increase cyberbullying.

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I. Introduction

The use of computers is ubiquitous in the educational system. In the United States, for example, virtually all instructional classrooms have computers with Internet access, with an average of one instructional computer for every three schoolchildren (U.S. Department of Education 2011). A growing number of state, school district and individual school programs have further increased the ratio of computers to students to as high as one to one through the provision of laptops to all schoolchildren and teachers (Silvernail et al. 2011; Texas Center for Educational Research 2009; Lowther 2007).[1] Most families also purchase computers for their children to use at home for schoolwork. The latest Current Population Survey (CPS) microdata with information on computer access indicate that 84 percent of children have access to a computer at home.

With increasing computer use among children, concerns over the broader social and psychological problems associated with the use of computers such as cyberbullying, social isolation, or displacement of "developmentally meritorious" activities (e.g., sports and social activities) have also increased sharply.[2] Surprisingly little rigorous research, however, explores the causes of social and emotional development related to the use of computers among children. Previous studies, based largely on descriptive data, argue that access to computers increases the total amount of time children spend using computers at the expense of other activities, thereby putting them at risk for obesity (Subrahmanyam et al, 2000). Researchers have also speculated that increased use of the Internet leads to increases in social isolation, as indexed by loneliness

[1] Extensive efforts to provide laptops to schoolchildren also exist in many developing countries. For example, the One Laptop per Child program has provided more than 2 million computers to schools in Uruguay, Peru, Argentina, Mexico and Rwanda, and new projects in Gaza, Afghanistan, Haiti, Ethiopia and Mongolia. See http://one.laptop.org/about/countries.

[2] Cyberbullying in particular has received a considerable amount of attention recently. See, for example, "As Bullies Go Digital, Parents Play Catch-Up." NY Times, December 4, 2010, and "How Big a Problem Is Bullying or Cyberbullying in Your School or Community?" NY Times, September 18, 2013.

and depression (Subrahmanyam, Kraut, Greenfield & Gross, 2001). Because computer-owning school children often report having a computer in their bedroom, it is possible that this solitary use robs children of actual interpersonal interactions in social activities and with friends (Roberts et al 1999). However, it is equally possible that children's "alone time" on computers extends social relationships by connecting with others through virtual interactions. In this way, computer ownership may complement, rather than substitute for, interpersonal interactions.

Given the dearth of evidence the state of knowledge in this area remains ambiguous. A related literature examines the educational value of home computers. Although home computers are useful for completing school assignments through word processing, research, spreadsheets and other educational uses, they also provide a distraction caused by game, social networking and other entertainment use.[3] In fact, there is no consensus in the literature on even whether the net effects of home computers on educational outcomes among schoolchildren are positive, negative or zero (Attewell and Battle 1999; Fiorini 2010; Schmitt and Wadsworth 2006; Fairlie 2005; Beltran, Das and Fairlie 2010; Malamud and Pop-Eleches 2011; Fairlie and Robinson 2013; Fuchs and Woessmann 2004; Vigdor and Ladd 2010; Malamud and Pop-Eleches 2011). The use of social networking sites such as Facebook and Myspace and other entertainment sites such as Youtube and iTunes among youth has exploded over the past decade.[4] Owing to this

[3] Surveys of home computer use among schoolchildren indicate high levels of use for both schoolwork and entertainment (see U.S. Department of Commerce 2004; Lenhart et al. 2008; Lenhart 2009; Pew Internet Project 2008a, 2008b; U.S. Department of Education 2011; Kaiser Family Foundation 2010 for example).

[4] The potential negative impact of the extensive use of Facebook among college students on academic outcomes has recently received some attention (Karpinski 2009 and Pasek and Hargittai 2009). These concerns are similar to those over television (Zavodny 2006).

proliferation concerns over the distraction effect caused by computers especially through game and social networking use have gained a fair amount of media attention.[5]

The lack of research on the social and psychological impacts of computer use arises from two main sources. First, data sources with information on both social and psychological outcomes and information on computer ownership and use are rare. The Computer and Internet Supplement to the Current Population Survey, for example, has detailed questions on computer ownership and use, but not on social and psychological outcomes. Second, and perhaps more important, the causal effects of home computers are difficult to identify because parents and children choose to purchase computers, and thus standard regression estimates would be subject to potential selection bias. It is not even clear which direction the selection bias is likely to go. On one hand, parents who are the most worried about their children having negative social effects from home computers will avoid purchasing them leading to negative bias. On the other, parents who are the most "educationally motivated" might be the ones that purchase home computers for schoolwork leading to a positive bias.

To address these limitations and concerns, we estimate the social and psychological impacts of home computers by conducting a randomized control experiment with 1,123 students in grades 6-10 attending 15 schools across California. It represents the first field experiment involving the provision of free computers to schoolchildren for home use ever conducted and the largest experiment involving the provision of free home computers to students at any level in the United States. None of the students participating in the study had computers at baseline. Half were randomly selected to receive free computers while the other half served as the control

[5] See, for example, "Computers at Home: Educational Hope vs. Teenage Reality," NY Times, July 10, 2010 and "Wasting Time Is New Divide in Digital Era," NY Times, May 29, 2012.

group. At the end of the school year, we collected detailed information on computer use for various activities and a range of social and psychological outcome measures.

To briefly preview the results, we find that the experiment had a large effect on computer ownership and total hours of computer use. Students in the treatment group report spending more time on computers for schoolwork, but they also spent more time on games, social networking and other entertainment. For social and psychological outcomes we find a significant and positive impact on the number of friends students report communicating with and on the amount of time students report actually hanging out with their friends. We find no evidence that students randomly assigned to receive a computer spend are any less likely to participate in sports teams or after school clubs or spend any less time in these activities. Finally, though treated students are more likely to report having an Internet connection and a social networking page, they are no more likely to report being the victim of cyberbullying. All told, the results portray a pattern of limited positive benefits to youth's social and emotional development and no such risks, at least according to the outcomes we have measured here.

2. Experimental Design

A. Sample of Schoolchildren

The sample for this study includes students enrolled in grades 6-10 in 15 different middle and high schools in 5 school districts in the United States (see Fairlie and Robinson 2013 for more details). Middle school students comprise the vast majority of the sample.[6] We focus on this age group because middle school captures a critical time in the emotional, social and educational development of children. The project took place over two years: two schools

[6] The distribution of grade levels is as follows: 9.5% grade 6, 47.8% grade 7, 39.9% grade 8, and 2.8% grades 9 and 10.

participated in 2008-9, twelve schools participated in 2009-10, and one school participated in both years. The 15 schools in the study span the Central Valley of California geographically. Overall, these schools are similar in size (749 students compared to 781 students), student to teacher ratio (20.4 to 22.6), and female to male student ratio (1.02 to 1.05) as California schools as a whole (U.S. Department of Education 2011). Our schools, however, are poorer (81% free or reduced price lunch compared with 57%) and have a higher percentage of minority students (82% to 73%) than the California average. They also have lower average test scores than the California average (3.2 compared with 3.6 in English-Language Arts and 3.1 compared with 3.3 in Math), but the differences are not large (California Department of Education 2010). Although these differences may impact our ability to generalize the results, low-income, ethnically diverse schools such as these are the ones most likely to enroll schoolchildren without home computers and be targeted by policies to address inequalities in access to technology (e.g. E-rate program and IDAs).

To identify children who did not have home computers, we conducted an in-class survey at the beginning of the school year with all of the students in the 15 participating schools. The survey, which took only a few minutes to complete, asked basic questions about home computer ownership and usage. To encourage honest responses, it was not announced to students that the survey would be used to determine eligibility for a free home computer (even most teachers did not know the purpose of the survey). Responses to the in-class survey are tabulated in Appendix Table A1. In total, 7,337 students completed in-class surveys, with 24 percent reporting not having a computer at home. This rate of home computer ownership is roughly comparable to the national average: – estimates from the 2010 CPS indicate that 27% of children aged 10-17 do not have a computer with Internet access at home (U.S. Department of Education 2011).

Any student who reported not having a home computer was eligible for the study.[7] In discussing the logistics of the study with school officials, school principals expressed concern about the fairness of giving computers to a subset of eligible children. For this reason, we decided to give out computers to *all* eligible students: treatment students received computers immediately, while control students had to wait until the end of the school year. Our main outcomes are all measured at the end of the school year, before the control students received their computers.

All eligible students were given an informational packet, baseline survey, and consent form to complete at home. To participate, children had to have their parents sign the consent form (which, in addition to participating in the study, released future grade, test score and administrative data) and return the completed survey to the school. Of the 1,636 students eligible for the study, we received 1,123 responses with valid consent forms and completed questionnaires (68.6%).[8]

B. Treatment

We randomized treatment at the individual level, stratified by school. In total, of the 1,123 participants, 559 were randomly assigned to the treatment group. The computers were

[7] Because eligibility for the study is based on not having a computer at home, our estimates capture the impact of computers on the social and psychological outcomes of schoolchildren whose parents do not buy them on their own and do not necessarily capture the impact of computers for existing computer owners. Schoolchildren without home computers, however, are the population of interest in considering policies to expand access.

[8] This percentage is lowered by two schools in which 35% or less of the children returned a survey (because of administrative problems at the school). However, there may certainly be cases in which students did not participate because they lost or did not bring home the flier advertising the study, their parents did not provide consent to be in the study, or they did not want a computer. Thus, participating students are probably likely to be more interested in receiving computers than non-participating students (which would also be the case in a real-world voucher or giveaway program). To deal with this, we focus on Intent-to-Treat effects in our main specifications. Note also that the results we present below are not sensitive to excluding the two schools with low participation rates.

purchased from or donated by Computers for Classrooms, Inc., a Microsoft-certified computer refurbisher located in Chico, California. The computers were refurbished Pentium machines with 17" monitors, modems, ethernet cards, CD drives, flash drives, Microsoft Windows, and Microsoft Office (Word, Excel, PowerPoint, Outlook). The computer came with a 1 year warranty on hardware and software during which Computers for Classrooms offered to replace any computer not functioning properly. In total, the retail value of the machines was approximately $400-500 a unit. Since the focus of the project was to estimate the impacts of home computers on educational outcomes and not to evaluate a more intensive technology policy intervention, no training or assistance was provided with the computers.[9]

The computers were handed out by the schools to eligible students in the late fall of the school year (they could not be handed out earlier because it took some time to conduct the in-school surveys, obtain consent, and arrange the distribution). Because the computers were handed out in the second quarter of the school year we use first quarter grades as a measure of pre-treatment performance and third and fourth quarter grades as measures of post-treatment performance. Almost all of the students sampled for computers received them: we received reports of only 11 children who did not pick up their computers, and 7 of these had dropped out of their school by that time. After the distribution, neither the research team nor Computers for Classrooms had any contact with students during the school year. In addition, many of the outcomes were collected at least 6 months after the computers were given out (for example, end-of-year standardized test scores and fourth quarter grades). Thus, it is very unlikely that student

[9] When the computers were handed out to students they were offered a partially subsidized rate for dial-up Internet service from ChicoNet ($30 for 6 months). They were also given some information about current Internet options available through AT&T (these options were available to everyone, not just participants).

behavior would have changed for any reason other than the computers themselves (for instance, via Hawthorne effects).

To measure the effects on social and psychological outcomes we conducted a follow-up survey at the end of the school year. Information on cyberbullying, social isolation and club and sports participation was included. The follow-up survey also included detailed questions about computer ownership, usage, and knowledge, homework time, and entertainment. These questions allow us to calculate a "first stage" of the program on computer usage, and to examine how computers given out through the experiment were used for schoolwork, games, social networking and other entertainment. We also administered a baseline survey which was required to participate in the project (as that was where consent was obtained). That survey includes additional information on student and household characteristics, and several measures of parental supervision and propensity for game use. Finally, the schools also provided us with detailed administrative data on educational outcomes (grades, test scores, disciplinary information, and enrollment information).

Attrition is relatively small with only 9% of the sample having left school by the end of the school year. Of the students enrolled in school at the end of the year, we have follow-up surveys for 85 percent of the students. The response rate was 84.3 percent for the control group and 85.4 percent for the treatment group. There is no statistically significant difference in response between the treatment and control groups. Administrative data provided by the schools on educational outcomes has essentially no attrition.

C. Summary Statistics and Randomization Verification

Table 1 reports summary statistics for the treatment and control groups and provides a balance check. In the table, Columns 1 and 2 report the means for the treatment and control groups, respectively, while Column 3 reports the p-value for a t-test of equality. Panel A reports demographic information from the school-provided administrative data and information from the baseline survey administered to all students. The average age of study participants is 12.9 years. The sample has high concentrations of minority and non-primary English language students: 55% of students are Latino, and 43% primarily speak English at home. Most students, however, were born in the United States: the immigrant share is 19%. The average education level of the highest educated parent is 12.8 years. From the baseline survey, we find that ninety percent of children live with their mothers, but only 58% live with their fathers. Students report that 47% of mothers and 72% of fathers are employed (conditional on living with the student).

Panel B reports information on grades in the quarter before the computers were disbursed (the first quarter of the school year) and previous year California STAR test scores as a further check of the randomization validity. The average student had a baseline GPA of roughly 2.5 in all subjects and 2.3 in academic subjects (which we define as Math, English, Social Studies, Science, and Computers). The average student received a score of roughly 2.9 (out of 5) on both the English-Language Arts and Math sections of the STAR test. Reassuringly, none of these means for baseline academic performance differ between the treatment and control groups.

Overall, we find very little difference between the treatment and control groups. The only variable with a difference that is statistically significant is that treatment children are more likely to have rules on how much TV they watch (although the difference of 0.05 is small relative to the base of 0.79). It is likely that this one difference is caused by random chance – nevertheless, we control for a large number of covariates in all of the regressions which follow.

3. Main Results

A. Computer Ownership and Usage

The experiment has a very large first-stage impact in terms of increasing computer ownership and hours of computer use. Table 2, Panel A reports treatment effects on computer ownership rates and total hours of computer use from the follow-up survey conducted at the end of the school year.[10] We find very large effects on computer ownership and usage. We find that 81% of the treatment group and 26% of the control group report having a computer at follow-up. While this first-stage treatment effect of 55 percentage points is very large, if anything it is understated because only a very small fraction of the 559 students in the treatment group did not receive one (as noted above, we had reports of only 11 students who did not pick up their computer). In addition, any measurement error in computer ownership would understate the first stage. The treatment group is also 25 percentage points more likely to have Internet service at home than the control group (42% of treatment students have Internet service, compared to 17% of control students).

We also have some estimates of total time use. We do not want to overemphasize these specific estimates of hours use, however, because of potential measurement error common in self-reported time use estimates. With that caveat in mind, we find large first-stage results on reported computer usage. The treatment group reports using a computer 2.5 hours more per week than the control group, which represents a substantial gain over the control group average of 4.2

[10] The estimated treatment effects are from linear regressions that control for school, year, age, gender, ethnicity, grade, parental education, whether the student's primary language is English, whether the student is an immigrant, whether the parents live with the student, and whether the parents have a job. Some of these variables are missing for some students. To avoid dropping these observations, we also include a dummy variable equal to 1 if the variable is missing for a student and code the original variable as a 0 (so that the coefficients are identified from those with non-missing values). Estimates of treatment effects are similar without controls.

hours per week.[11] Reassuringly, this increase in total hours of computer use comes from home computer use. The similarity between the point estimate on total computer time and the point estimate on home computer time suggests that home use does not crowd out computer use at school or other locations.

B. Impacts of Computers on Social Networking, Email and Cyberbullying

We first examine the impact of home computers on the overall activities of schoolchildren. Table 3 reports how children use the computers. The computers were used for both educational and non-educational purposes. Children spend an additional 0.8 hours on schoolwork, 0.8 hours per week on games, 0.6 hours on social networking, and 0.4 hours on email.[12] All of these increases are large relative to the control group means of 1.9, 0.8, 0.6, and 0.3, respectively. Though we do not want to overemphasize the specific point estimates given possible underreporting of time use, the finding of home computer use for both schoolwork and entertainment purposes among schoolchildren is common to numerous national surveys of computer use (see Pew Internet Project 2008a, 2008b, U.S. Department of Education 2011, Kaiser Family Foundation 2010 for example). The findings are also suggestive that children report increased use of computers for activities that might be both social isolating (i.e. game use) and social participating (i.e. email and social networking).

Table 4 expands the focus from hours of computer use for various activities to social activities that are related to computer use. All of the estimates reported are from regressions that

[11] The 4.2 hours that control students spend on computers is spent mostly at school and in other locations (i.e. libraries, or a friend or relative's house). But, we do not find evidence of more hours of computer use by the control group at other locations which include a friend's house suggesting that these students did not indirectly benefit from using the computers at the homes of the treatment students.
[12] We also find larger medians and distributions that are to the right for the treatment group for these measures of schoolwork and game/networking use.

include the treatment variable and controls for student characteristics. One clear benefit from having a home computer is that schoolchildren were more likely to report showing their parents how to do something on the computer. Having a home computer might increase communication between schoolchildren and their parents as the students explain how to use computers. Often children are less afraid of technology and it might be empowering that they can teach their parents something new. Related to this question, however, we do not find that home computers increase the likelihood that students received help on school assignments from other students, friends, or teachers by email, instant messaging or social networking.

Having a home computer appears to increase the likelihood of having a social networking page. This is consistent with the increased hours of use of computers for social networking reported in Table 3. As noted above, there are substantial concerns over cyberbullying among children.We asked students on the follow-up survey "Over the past school year have you ever been bullied, teased, or threatened online or by email." We do not find, however, that home computers increased the likelihood of reporting cyberbullying (from a base on 0.08 for the control group).

All of these measures are directly related to social activities on computers. We now turn to examining social participation measures that are broader or independent of use of computers.

C. Impacts of Computers on Social Participation

There are concerns that home computers lead to social isolation among schoolchildren. We explore this question by examining the impact of home computers on objective measures of social activities. Interactions with friends and participation in after-school clubs and activities are measured and examined. Table 4 reports estimates. We find that home computers actually

increase the number of friends that students communicate with outside of school hours and increase the number of hours hanging out with friends. Both of these estimated impacts are large relative to the control group mean. For the other measures of social interaction with friends we find positive, but statistically insignificant point estimates.

To provide additional evidence on the overall effects of home computers on social participation we create a summary index that aggregates information over multiple treatment effect estimates (Kling, Liebman and Katz 2007). Specifically, we create an index of the social interaction with friends measures that combines the four measures reported in Table 4. By aggregating the separate educational outcomes we improve the statistical power of treatment effect estimates. To create the index we first calculate z-scores for each of the dependent variables by subtracting the control group mean and dividing by the control group standard deviation. Thus, each dependent variable has mean zero and standard deviation equal to one for the control group. The educational outcome index is then calculated from an equally-weighted average of the z-scores for the four dependent variables. The treatment effect estimate for this index indicates where the mean of the treatment group is in the distribution of the control group in terms of standard deviation units.

Table 7 reports estimates for the social interaction with friends outcome index. By definition the control group mean for the index is 0. The treatment effect estimate is positive and statistically significant. The point estimate of 0.10 implies that the treatment group mean is 0.10 standard deviations higher than the control group mean. The treatment effect estimate for the summary measure of educational outcomes provides additional evidence that home computers increase social interactions with friends.

In Table 5, we examine the effects of home computers on social participation by examining participation in sports, clubs, and other after-school activities. Participation in after-school activities provides an objective measure of social participation. Using measures of participation and hours, we find no evidence of negative effects of home computers. Estimates for a summary z-score for these four variables confirm this finding (see Table 7). Having a home computer does not appear to lead to increasing social isolation by crowding out after-school activities.

D. Impacts on School Engagement

We can also measure whether home computers affect engagement in school through their impacts on the number of absences, unexcused absences, tardies, and days suspended, and whether the student was still enrolled in the school at the end of the school year. We also measure each of these outcomes as incidence (i.e. 0/1) instead of the number of times or days. Table 6 reports estimates for each measure, and Table 7 reports the summary z-score estimate. We find no evidence of negative effects of home computers on school engagement and participation. In fact, many of the treatment effect point estimates are negative, which would imply that home computers increase school engagement and participation if they were significant.

4. Treatment Heterogeneity

In this section, we explore whether there is heterogeneity in treatment effects by various baseline characteristics. We focus specifically on characteristics predicting or actual measures of pre-treatment social participation. Focusing on these particular measures is partly motivated by

findings from the previous literature, and all of these measures were pre-identified at the start of the project (which is why they were asked at baseline).

Table 8 reports estimates of heterogeneous treatment effects for these variables. For gender, we find some evidence that the increase in the number of friends communicated with from having a home computer is primarily driven by boys. The differential, however, is statistically insignificant and we find small differential treatment estimates for the other outcomes. We next report estimates for interacting treatment with children reporting hanging out with few friends at baseline (less than 4 which is roughly the median). We do not find evidence of differential treatment effects by baseline interaction with friends. Finally, we interact treatment with whether the student reports having a social networking page at baseline (which 40 percent did). We find some evidence suggesting a negative relative effect on social interaction with friends and in after-school activities for students who had a social networking page at baseline.

5. Conclusion

Concerns over the perceived negative impacts of computers on social and psychological outcomes among schoolchildren, such as cyberbullying and social isolation, are prevalent but largely unsubstantiated with plausibly causal evidence. We provide direct evidence on this question by performing an experiment in which 1,123 schoolchildren grades 6-10 across 15 different schools and 5 school districts in California were randomly given computers to use at home. The experiment substantially increased computer ownership and usage without causing substitution away from use at school or other locations outside the home.

We find that home computers increase total use of computers for social networking and email. At the same time, home computers also increase the total use of computers for games and other entertainment, which might be socially isolating. However, we find no such evidence that this is the case. In fact, we find a significant and positive impact on the number of friends treated students report communicating with and on the amount of time students report actually hanging out with their friends. We find no evidence that students randomly assigned to receive a computer spend are any less likely to participate in sports teams or after school clubs or spend any less time in these activities. Finally, though treated students are more likely to report having an Internet connection and a social networking page, they are no more likely to report being the victim of cyberbullying. All told, the results portray a pattern of limited positive benefits to youth's social and emotional development and no such risks, at least according to the outcomes we have measured here.

An important caveat to our results is that there might be other social effects of having a computer that are not easily measurable. For example, computers may be useful for finding information about colleges, jobs, health and consumer products, and may be important for doing well later in higher education. It might also be useful for communicating with teachers and schools and parental supervision of student performance through student information system software.[13] A better understanding of these potential benefits is important for future research.

[13] Student information system software that provides parents with nearly instantaneous information on their children's school performance, attendance and disciplinary actions is becoming increasingly popular in U.S. schools (e.g. School Loop, Zangle, ParentConnect, and Aspen). We find evidence from the follow-up survey of a positive effect of home computers on whether parents check assignments, grades and attendance online using these types of software.

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Table 1. Individual Level Summary Statistics and Balance Check

	Control	Treatment	Equality of means *p-val*	Obs.
Panel A. Student and family characteristics				
Age	12.91	12.90	0.91	1107
	0.87	0.84		
Female	0.51	0.50	0.66	1123
	0.50	0.50		
Ethnicity = African American	0.13	0.14	0.86	1103
	0.34	0.34		
Ethnicity = Latino	0.56	0.55	0.76	1103
	0.50	0.50		
Ethnicity = Asian	0.12	0.14	0.42	1103
	0.33	0.34		
Ethnicity = White[1]	0.16	0.14	0.56	1103
	0.36	0.35		
Immigrant	0.21	0.18	0.15	1092
	0.41	0.38		
Primary language is English	0.43	0.43	0.97	1102
	0.50	0.50		
Parent's education[2]	12.81	12.76	0.64	729
	1.44	1.49		
Number of people living in household	4.98	5.02	0.79	1103
	2.43	2.55		
Lives with mother	0.92	0.89	0.12	1123
	0.28	0.32		
Lives with father	0.58	0.58	0.90	1123
	0.49	0.49		
Does your mother have job?[4]	0.47	0.46	0.68	990
	0.50	0.50		
Does your father have a job?	0.73	0.70	0.36	632
	0.44	0.46		
Panel B. Pre-treatment grades and test scores				
Grade point average in all subjects	2.56	2.53	0.54	1098
(in Quarter 1)	0.92	0.92		
Grade point average in academic subjects	2.35	2.29	0.30	1098
(in Quarter 1)[3]	1.05	1.05		
California STAR test in previous year	2.89	2.92	0.76	929
(English)	1.06	1.11		
California STAR test in previous year	2.91	2.92	0.80	899
(Math)	1.10	1.12		

*Notes: In Columns 1 and 2, means reported with standard errors in parentheses. Column 3 reports the p-value for the t-test for the equality of means. ***, **, * indicates significance at 1, 5 and 10%.*

[1] *Omitted ethnicity category is "not reported."*

[2] *This is the highest education level of either parent (which is the measure most schools in our sample collected).*

[3] *Academic subjects include math, science, English, social studies, and computers.*

[4] *The variables for mother's and father's job is reported only for households in which the given parent lives in the household.*

Table 2. Effect of Program on Computer Ownership and Usage

	(1)	(2)	(3)	(4)	(5)	(6)
			Hours of Computer Use Per Week			
	Owns a Computer	Has Internet Connection	Total	At Home	At School	At Other Location
Panel A. Computer Ownership and Usage						
Treatment	0.55	0.24	2.52	2.59	-0.02	-0.05
	(0.03)***	(0.03)***	(0.48)***	(0.32)***	(0.17)	(0.29)
Observations	852	831	755	755	755	755
Control mean	0.26	0.17	4.23	0.76	1.59	1.89
Control std. dev.	0.44	0.38	5.22	2.31	2.32	3.98
	Hours of Computer Use Per Week					
	Schoolwork	Email	Games	Net-working	Other	
Panel B. Activities on Computer						
Treatment	0.77	0.42	0.83	0.59	0.18	
	(0.25)***	(0.12)***	(0.22)***	(0.18)***	(0.11)	
Observations	671	671	671	671	671	
Control mean	1.89	0.25	0.84	0.57	0.62	
Control std. dev.	2.57	0.72	1.81	1.79	1.39	

*Notes: Data is from follow-up survey completed by students. Regressions control for the sampling strata (school*year). We also include controls for age, gender, ethnicity, grade, parental education, whether the student's primary language is English, whether the student is an immigrant, whether the mother/father lives with the student, and whether the mother/father has a job. To avoid dropping observations, for each variable, we create a dummy equal to 1 if the variable is missing for a student and code the original variable as a 0 (so that the coefficients are identified from those with non-missing values).*
****, **, * indicates significance at 1, 5 and 10%.*

Table 3. Social Outcomes Related to Computer Use

	(1)	(2)	(3)	(4)	(5)
	Show parents how to do something on computer	Do you have a social networking page?	Bullied online or via email	Received help from teacher or classmate via Internet / email	
Panel A. Adjusted for Ba	f_show_parents	!1b_social_networki	f_23_bullied	f_24_help_online	
Treatment	0.43	0.09	0.03	0.02	
	(0.03)***	(0.04)**	(0.02)	(0.03)	
Observations	700	692	852	851	
Control mean	0.12	0.53	0.08	0.37	
Control std. dev.	0.32	0.50	0.28	0.48	

Notes: Data is from follow-up survey completed by students. See the notes to Table 2 for the list of controls.
****, **, * indicates significance at 1, 5 and 10%.*

Table 4. Social Outcomes Related to Friends

	(1)	(2)	(3)	(4)	(5)
	Friends communicate with per week	Friends hang out with outside	Nights hang out outside	Hours per week hanging out with friends	Hours per week phone and texting
Treatment	1.57	0.31	0.22	0.72	0.03
	(0.59)***	(0.45)	(0.16)	(0.38)*	(0.48)
Observations	820	837	679	847	846
Control mean	6.71	5.62	1.72	3.16	3.38
Control std. dev.	8.19	6.52	1.89	5.16	7.19

Notes: Data is from follow-up survey completed by students. See the notes to Table 2 for the list of controls.
****, **, * indicates significance at 1, 5 and 10%.*

Table 5. Social Outcomes Related to Sports, Clubs and Other After-School Activities

	(1) Sports team participation	(2) Hours per week playing sports	(3) School club/after-school activity participation	(4) Hours per week in after-school activities
Treatment	-0.01	0.42	-0.03	0.02
	(0.03)	(0.27)	(0.03)	(0.16)
Observations	850	849	846	844
Control mean	0.36	2.59	0.38	0.92
Control std. dev.	0.48	3.28	0.49	2.22

Notes: Data is from follow-up survey completed by students. See the notes to Table 2 for the list of controls.
****, **, * indicates significance at 1, 5 and 10%.*

Table 6. Social Outcomes Related to School Participatoin

	(1) Total Absences	(2) Unexcused Absences	(3) Number of Tardies	(4) Days Suspended	(5) Still enrolled at End of Year
Panel A. Number of Times					
Treatment	-0.63	-0.33	-0.26	-0.30	
	(0.61)	(0.38)	(0.93)	(0.31)	
Observations	1044	1104	1104	1106	
Control mean	10.81	4.94	11.53	1.41	
Control std. dev.	11.87	7.84	17.00	6.50	
Panel B. Percentage with at Least One Occurance					
Treatment	0.00	0.01	-0.03	0.00	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	1044	1104	1104	1106	1123
Control mean	0.86	0.65	0.87	0.17	0.88
Control std. dev.	0.35	0.48	0.34	0.37	0.33

Notes: Data is from administrative data provided by schools. See the notes to Table 2 for the list of controls.
****, **, * indicates significance at 1, 5 and 10%.*

Table 7. Z-Scores for Summary Measures of Social Participation

	(1)	(2)	(3)	(4)
	Hanging out with friends summary	Sports, clubs and other activities summary	School participation summary	All three categories summary
Panel A. Adjusted for Baseline Controls				
Treatment	0.10	0.01	-0.03	0.01
	(0.05)*	(0.05)	(0.03)	(0.03)
Observations	636	826	1044	586
Control mean	-0.05	0.00	0.01	-0.04
Control std. dev.	0.65	0.66	0.62	0.38

Notes: Data is from follow-up survey completed by students and administrative data provided by schools. See the notes to Table 2 for the list of controls. See text for more details on calculation of z-scores for summary measures of social participation.
****, **, * indicates significance at 1, 5 and 10%.*

Table 8. Heterogeneity by Baseline Characteristics and Behavior

	(1)	(2)	(3)	(4)		(5)
	Hours of computer use	Bullied online or via email	Friends communicate with per week	Friends summary z-score	Sports, clubs and activities z-score	School participation z-score
Panel A. Male Interaction						
Treatment	3.05	0.03	0.52	0.09	0.05	-0.05
	(0.69)***	-0.03	-0.82	-0.08	-0.07	-0.05
Male student	0.69	0.01	-0.33	0.16	0.33	0.10
	-0.68	-0.03	-0.83	(0.08)**	(0.07)***	(0.05)**
Male student * treatment	-1.04	0.00	1.74	0.01	-0.07	0.04
	-0.97	-0.04	-1.18	-0.11	-0.10	-0.06
Observations	755	852	820	636	826	1044
Panel B. Hang out with Few Friends at Baseline						
Treatment	2.13	0.04	1.15	0.12	0.01	-0.03
	(0.66)***	-0.03	-0.82	-0.07	-0.07	-0.05
Hang out with few friends	0.38	0.01	3.12	0.34	0.15	0.11
	-0.67	-0.03	(0.82)***	(0.08)***	(0.07)**	(0.05)**
Few friends * treatment	0.82	0.00	0.48	-0.02	0.01	0.00
	-0.95	-0.04	-1.16	-0.11	-0.09	-0.07
Observations	720	815.00	787.00	621.00	794.00	1003.00
Panel C. Have Social Networking Page at Baseline						
Treatment	2.20	0.05	2.34	0.19	0.08	-0.04
	(0.61)***	(0.03)**	(0.73)***	(0.07)***	-0.06	-0.04
Have social networking pa	-0.53	0.07	4.44	0.31	0.06	0.11
	-0.73	(0.03)**	(0.88)***	(0.08)***	-0.07	(0.05)**
Social networking * treatn	1.20	-0.06	-3.02	-0.28	-0.18	-0.01
	-1.00	-0.04	(1.19)**	(0.11)**	(0.10)*	-0.07
Observations	743	840	811	627	814	1032

Notes: Data is from administrative data provided by schools. See the notes to Table 2 for the list of controls.
****, **, * indicates significance at 1, 5 and 10%.*