

HOMEWORK IN CYBER SCHOOLS

An Exploratory Study in an American School

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Research suggests that homework has moderately positive impacts on student learning in brick-and-mortar schools (Marzano & Pickering, 2007), but no prior research has explored such relationships in cyber schools. We surveyed parents ($n = 232$) and students ($n = 269$) at an American cyber school, and collected student achievement data. For students and parents, findings indicate modest direct relationships between homework and grades and retention. For parents we also find evidence of direct relationships between homework and perceived school quality. Stronger relationships are found for the students' prior traditional school than for the cyber school, suggesting the inchoate nature of homework in a setting where the home is the school.

INTRODUCTION

Many nations possess cyber schooling (Anderson & Simpson, 2012; Davis, 2012; Roberts, 2009). In America, cyber schooling has become increasingly important and increasingly diverse, with an estimated 200,000 students enrolled in 311 cyber schools in 2011–12 (Molnar, 2014; Roblyer, 2006; U.S. Department of Education, 2014). The few studies extant suggest somewhat higher levels of student, parent, and teacher satisfaction than in face-to-face schools (Beck, Egalite, & Maranto, 2014; Beck & Maranto, 2014). Most studies of student-level value added find cyber schools somewhat less effective than face-to-

face schools (Minnesota Office of the Legislative Evaluator, 2011; Woodworth et al., 2015; Woodworth & Raymond, 2013), though at least one state-level study found greater academic gains than in brick-and-mortar peers (Lueken, Ritter, & Beck, 2015).

While most attention to cyber schooling focuses on outcomes, cyber learning by definition makes different use of academic inputs. Academic inputs can be measured in a variety of ways, including teacher experience and education, class size, and spending per student (Grubb, 2009; Hanushek & Lindseth, 2009). Another nearly ubiquitous and sometimes controversial input that has been explored in face-to-face instruction is homework. Cooper, Rob-

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inson, and Patall (2006) analyzed homework research from 1987–2004, finding that homework has a significant positive effect on academic achievement as measured by test scores on the secondary level, with inconsistent impacts in elementary grades and evidence of diminishing and even negative returns, findings echoed by other researchers (Cooper & Valentine, 2001; Markow, Kim, & Liebman, 2007; Marzano & Pickering, 2007). Of course these statistics are at a high level of aggregation. For disadvantaged students, who may start school less academically prepared, additional homework may help close achievement gaps, as extensive scholarship suggests (Chall, 2000; Lareau, 2004; Lauer et al., 2006; Tam & Chan, 2011; Thernstrom & Thernstrom, 2003).

While the research on homework and achievement is extensive and fairly consistent, it has not been applied to cyber schooling. Homework may look very different in a cyber school, given the differences in delivery formats (asynchronous or synchronous), class sizes, and the very definition of homework as something a student does away from school, while all of cyber schooling occurs in the home. We measure the statistical relationships between reported nights of homework and parental and student measures of school quality, as well as on student achievement as measured by grades, persistence, and standardized test scores within a cyber school we will refer to as Sun Tech.

We emphasize that this is an exploratory study of a single cyber school. As in most such studies the supposed independent variable, homework, defies easy measurement. Students who report more homework may do so since they receive more homework than others, because they need more time to complete the same homework because they are behind academically, or simply because they show greater diligence, completing all rather than some homework. Regarding the latter relationship, homework could serve as either a dependent or independent variable. A student with greater commitment to his or her school—that is, with greater positive affect toward the

school—might be willing to spend more time on homework than a disaffected peer (Willingham, 2009). Yet homework could serve as an independent variable: students who spend more time doing homework may then improve their knowledge, skills, and ultimately grades and retention/graduation (Dweck, 2012). In short, we will report statistical relationships, but can only speculate as to causation. We do think it likely that, as the work summarized by Cooper and others suggests, homework is subject to diminishing and eventually negative returns: Too little homework indicates insufficient academic challenge; too much indicates unrealistic expectations. Accordingly, we suspect that even in a cyber school moderate levels of homework will be associated with higher levels of student and parent satisfaction, and more positive academic outcomes such as higher grades and greater persistence.

METHODS

Participants and Procedure

We surveyed students and parents at an American cyber charter school that we will call Sun Tech. We selected Sun Tech because it is a large and growing cyber charter secondary school (Grades 7–12). Sun Tech is an online cyber charter high school with about 750 students, founded by the leader of a social services nonprofit serving at-risk youth in the state's largest city.

Implementing Dillman's tailored method design (Dillman, Smyth, & Christian, 2009), the researchers sent notification e-mails to the potential respondents who had been at Sun Tech for at least 1 year. A week later, an online survey tool, Qualtrics, was used and the online link of the survey was e-mailed to all parents and students. Respondents were sent \$10 gift cards. In total, 269 students (53.7% response rate) and 232 parents (48.7% response rate) participated in this online survey between September 2011 and December 2011.

Self-reported data indicated that Sun Tech families were less educated but otherwise

resembled the state population. Only 15.1% of Sun Tech parents identified themselves as college graduates, compared with 24.8% of state residents over 25. Sun Tech students self-identified as 85% white, 15% African American, 7% Hispanic, and 2% Asian, each within the confidence interval for the state's public school students generally (some students self-identified as more than one race). The median Sun Tech student enters the school reading approximately 4 years below grade level.

Measures

The student survey consisted of 66 items that assess three scales (i.e., Reasons for choosing this school, Involvement, and Satisfaction) and general demographic information. Survey items were validated in prior surveys of secondary school students. These questions were taken from Liu, Black, Algina, Cavanaugh, and Dawson (2010) and Chubb and Moe (1990).

Two dependent variables measured school satisfaction. The Satisfaction Scale is a 14-item index with individual items on a 5-point Likert-type scale ranging from 1 (*very dissatisfied*) to 5 (*very satisfied*), regarding peer relations, teacher-student relations, and teacher expectations. We use a question regarding satisfaction with the school's academic quality as a dependent variable by itself. Parents and students were asked to rate their school using a standard "A" through "F" grading scale. Finally, nights of homework per week comes from student self-reports.

Student grade point averages (GPA) and standardized test scores for the 2011–12 school year for students responding to this survey were provided by Sun Tech.

CORRELATION RESULTS

We first provide a purely descriptive look at the correlations between our dependent variables of academic quality and school grade and other variables of interest. Table 1 indicates

that as reported nights of homework increase, parents are more likely to grade the school positively. Note that due to the way grades were coded, with A = 1 and F = 5, a negative coefficient indicates a positive relationship. Cooper et al. (2006) and others suggest the relationships between homework and school quality may be curvilinear; hence we will employ ordered logistic regression methods with a quadratic variable for homework. Table 2 analyses fail to find a clear relationship between reported nights of homework and subjective measures of school quality. While school grade given by students has a statistically significant correlation with the number of nights students had homework, it is quite small.

There are no direct relationships between homework and other variables of interest, with five notable exceptions. First, as student-reported homework increases, GPA for that semester (fall) increases ($p < .01$); there is no relationship between reported homework and spring GPA. Second, parent-reported homework has a marginally significant positive impact on fall GPA ($p < .1$), but, unlike student-self report, an even stronger relationship with Spring GPA ($p < .01$). Third, we find a modest positive relationship between student-reported homework and retention in grade ($p < .01$). Fourth, students from families headed by a single mother report doing significantly less homework than their peers ($p < .01$). Fifth, there are strong and significant relationships between student-reported assistance on homework from the father on both fall GPA ($p < .01$) and spring GPA ($p < .05$). We find no such relationships for mothers.

CORRELATION DISCUSSION

As noted above, additional reported homework increases actual GPA, with the strongest impacts on fall GPA for students and on spring GPA for parents. Possibly, parental judgments lag behind those of students, though more inquiry is needed. At the very least, findings suggest positive short-term effects of home-

TABLE 1
Correlations for Parent Survey Responses

	School Quality	School Grade	Nights of HW	Retained	Graduated	Withdrew	GPA S1	GPA S2	Writing Score	Reading Score	Math Score	Science Score	Father Helps w/ HW	Mother Helps w/ HS	Single Mother	Single Divorced Mother
School quality	1															
School grade	-0.502***	1														
Nights of HW	0.088	-0.184**	1													
Retained	-0.081	-0.096	0.026	1												
Graduated	-0.133	0.03	-0.135	0.348***	1											
Withdrew	0.103	-0.021	-0.05	-0.685***	-0.399***	1										
GPA S1	0.017	-0.152	0.176*	0.361***	0.355***	-0.393***	1									
GPA S2	0.01	-0.258**	0.311***	0.309***	0.309***	-0.462***	0.844***	1								
Writing test score	.	-0.072	-0.593	-0.149	-0.037	-0.066	0.053	0.117	1							
Reading test score	0.031	-0.155	0.154	0.088	0.268	-0.187	0.377**	0.487***	0.613***	1						
Math test score	-0.173	-0.065	0.265	0.128	-0.01	-0.126	0.61***	0.723***	0.56***	0.753***	1					
Science test score	0.231	-0.24	0.178	0.066	0.01	0.125	0.345**	0.498***	0.542**	0.867***	0.855***	1				
Father helps w/ HW	-0.116	0.079	-0.177**	-0.073	0.052	0.094	0.115	0.067	0.078	0.065	-0.311	0.261	1			

Mother helps w/ HS	-0.099	0.044	0.046	0.117	-0.15	-0.045 *	0.008	-0.034	-0.392	-0.073	-0.118	-0.255	0.374 ***	1
Single mother	0.057	-0.125	0.114	0.137	0.014	-0.029	-0.093	-0.079	-0.676 *	-0.66 **	-0.448	-0.4 *	-0.135	1
Single/divorced mother	0.066	-0.053	0.209 **	-0.11	0.058	0.09	0.098	0.182	-0.103	-0.394	-0.306	0.016	0.149 *	0.302
														1

Note: Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. School grade is coded A = 1, B = 2, C = 3, D = 4, F = 5. This results in correlations between slightly counterintuitive when interpreting.

TABLE 2
Correlations for Student Survey Responses

	School Quality	School Grade	Nights of HW	GPA S1	GPA S2	Retained	Grad- uated	Withdrawn	Writing Test Score	Reading Test Score	Math Test Score	Science Test Score	Father Helps w/ HW	Mother Helps w/ HS	Single Mother	Single/ Divorced Mother
School quality																
School grade	-0.532 ***															
Nights of HW	-0.011	-0.04														
GPA S1	0.039	-0.069	0.194 ***													
GPA S2	-0.016	-0.023	0.007	0.842 ***												
Retained	0.123	-0.08	0.13 *	0.365 ***	0.326 ***											
Gradu- ated	0.02	-0.023	-0.115 *	0.319 ***	0.255 ***	0.425 ***										
With- drew	-0.102	0.129	0.002	-0.383 ***	-0.458 ***	-0.667 ***	-0.478 ***									
Writing test score	-0.12	0.404	-0.301	0.07	0.117	-0.174	-0.058	-0.058								
Reading test score	-0.179	0.362	0.16	0.391 **	0.477 ***	0.09	0.212	-0.241	0.62 ***							
Math test score	-0.054	0.165	0.116	0.686 ***	0.738 ***	0.102	-0.128	-0.17	0.572 ***	0.72 ***						
Science test score	-0.115	0.233	0.156 **	0.4	0.504	0.009	-0.047	0.126	0.562	0.848	0.849					

Father helps w/ HW	-0.03	-0.007	0.04	0.226***	0.171**	-0.083	0.005	-0.064	-0.248	0.043	0.043	0.143
Mother helps w/ HS	0.01	-0.07	0.019	-0.018	-0.025	-0.047	-0.129**	0.098	-0.434*	-0.367**	-0.16	-0.167
Single mother	0.103*	-0.015	-0.119*	-0.222***	-0.149**	-0.039	0.028	0.078	-0.276	-0.309*	-0.45***	-0.294*
Single/divorced mother	-0.074	0.049	0.026	0.049	0.099	-0.072	-0.008	0.06	0.165	0.081	0.029	0.188
												0.014
												0.144***
												0.36

Note: Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ School grade is coded A = 1, B = 2, C = 3, D = 4, F = 5. This results in correlations between slightly counterintuitive when interpreting.

work, given that the surveys were conducted in the fall. This accords with prior research indicating medium to large effect sizes for homework in high school, particularly for poorly performing students (Chall, 2000; Cooper et al., 2006; Lauer et al., 2006; Marzano & Pickering, 2007; Stinebrickner & Stinebrickner, 2008; Willingham, 2009).

In sharp contrast, our third finding above indicates that students reporting more homework are more likely to be retained in grade. Possibly, students who are well behind spend more time on homework to catch up (Cooper et al., 2006; Lauer et al., 2006). Further, teachers may well assign additional work to individual students who are below grade level (Blankstein, 2010; Lemov, 2010). As noted above, the median Sun Tech student enters the school roughly 4 years below grade level in reading.

Our fourth finding indicates that students from single-parent families do less homework than their peers, possibly reflecting lower levels of parental monitoring (Mayer, 1997; Pearlstein, 2011). Cyber schools that utilize the home facilitator approach (using parents or guardians) may do well to emphasize better training for these facilitators in motivating and monitoring. Similarly, we found strong and significant relationships between student-reported assistance on homework from the father on both fall GPA and spring GPA, in accord with prior work in brick-and-mortar schools (Mayer, 1996; Pearlstein, 2011).

ORDERED LOGIT AND ORDINARY LEAST SQUARES REGRESSION RESULTS

Using ordered logit (see Table 3) to accommodate the ordinal A–F grades that students and parents assigned Sun Tech, we controlled for student background variables. We were unable to test our parallel regressions assumption due to the small sample size in some categories; so, results should be interpreted with caution. We find no statistically significant results for the relationship between the nights of homework

and the grade parents and students gave their cyber school. In contrast, both students and parents gave their prior brick-and-mortar school a higher grade when the student was assigned more nights of homework.

An analysis of variance (ANOVA) was also conducted to determine the potential differences between nights of homework reported by parents and students with the grade that they assigned to Sun Tech and their prior school. This method enabled us to view school grades as they related to each number of reported nights of homework individually. Student results in Table 4 showed reported homework improved the grade they assigned Sun Tech for 3 ($p < .10$) and 4 ($p < .05$) nights of homework, but not for 5 nights. The strongest impact was for 4 nights, again suggesting a homework sweet spot (Cooper et al., 2006). For parents, in contrast, 3 and 5 nights of homework were associated with higher grades given to Sun Tech. For students and parents, only 3 nights of homework is associated with higher grades for their previous school (students $p < .05$; parents $p < .10$). We maximized the number of nights of homework, finding that for parents and students, the ideal number of nights of homework is 3.79.

Table 5 shows the analysis of the reported nights of homework and student and parent satisfaction with school academic quality for their current cyber school and prior school using ANOVA. Results for satisfaction closely mirror the parent and student reported grades given to each school. We saw marginally statistically significant positive findings for student reported satisfaction when they stated that they had four nights of homework at their cyber school. In contrast, satisfaction with their prior school was marginally significant at three nights of homework a week. For their prior school, parents were dissatisfied with the school's academic quality when they reported that the student had five nights of homework. These results may indicate that, to parents and students, homework is defined very differently in traditional and cyber environments.

TABLE 3
Logit Regression Measuring Nights of Reported Homework and Grade Given to Sun Tech and Prior School

Variables	<i>Sun Tech</i>				<i>Previous School</i>			
	<i>Student</i>		<i>Parent</i>		<i>Student</i>		<i>Parent</i>	
	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>
Nights of HW	−0.649 [0.480]	0.522 [0.251]	0.239 [0.969]	1.27 [1.231]	−1.838*** [0.461]	0.159*** [0.0734]	−2.411*** [0.901]	0.0897*** [0.0809]
Nights of HW squared	0.077 [0.060]	1.08 [0.0649]	−0.062 [0.110]	0.94 [0.103]	0.242*** [0.057]	1.274*** [0.0728]	0.318*** [0.106]	1.374*** [0.146]
Gender: Male	0.284 [0.283]	1.329 [0.377]	0.531 [0.379]	1.7 [0.644]	−0.115 [0.250]	0.891 [0.223]	0.076 [0.342]	1.079 [0.369]
Mother's high level of Ed.	0.002 [0.140]	1.002 [0.140]	0.292 [0.194]	1.339 [0.260]	−0.339*** [0.121]	0.712*** [0.0862]	−0.437** [0.176]	0.646** [0.114]
Mother help with HW	−0.407 [0.357]	0.666 [0.237]	0.193 [0.462]	1.212 [0.560]	0.466 [0.313]	1.594 [0.499]	1.255*** [0.450]	3.509*** [1.580]
Father help with HW	0.327 [0.545]	1.386 [0.755]	−0.225 [0.681]	0.798 [0.544]	−0.366 [0.498]	0.694 [0.346]	−0.485 [0.643]	0.615 [0.396]
Other help with HW	−0.488 [0.546]	0.614 [0.335]	−0.823 [0.784]	0.439 [0.344]	0.7 [0.451]	2.013 [0.909]	1.285** [0.644]	3.615** [2.328]
Race: White	0.375 [0.499]	1.455 [0.726]	−0.278 [1.086]	0.757 [0.823]	−0.609 [0.443]	0.544 [0.241]	−0.241 [0.826]	0.785 [0.649]
Race: Hispanic	−0.378 [0.513]	0.685 [0.351]	−2.548** [1.252]	0.0782** [0.0979]	0.137 [0.436]	1.147 [0.500]	−0.743 [0.708]	0.476 [0.337]
Race: Black	−0.255 [0.555]	0.775 [0.430]	−0.944 [1.056]	0.389 [0.411]	0.357 [0.483]	1.429 [0.690]	0.268 [0.802]	1.308 [1.049]
9th grade	0.181 [0.479]	1.198 [0.574]	0.377 [0.645]	1.459 [0.941]	0.078 [0.409]	1.081 [0.442]	0.899 [0.639]	2.458 [1.570]
10th grade	0.382 [0.482]	1.465 [0.705]	0.719 [0.680]	2.052 [1.395]	−0.511 [0.424]	0.6 [0.254]	−0.268 [0.639]	0.765 [0.489]
11th grade	0.031 [0.465]	1.031 [0.479]	1.061 [0.658]	2.889 [1.900]	−0.429 [0.394]	0.651 [0.257]	0.054 [0.633]	1.056 [0.668]
12th grade	0.035 [0.485]	1.035 [0.502]	0.587 [0.678]	1.799 [1.219]	−0.248 [0.410]	0.78 [0.320]	0.042 [0.648]	1.043 [0.675]
Constant —cut 1	−0.356 [1.259]	0.701 [0.882]	0.84 [2.511]	2.317 [5.820]	−6.930*** [1.182]	0.000978*** [0.00116]	−7.180*** [2.067]	0.000761*** [0.00157]
Constant —cut 2	1.902 [1.272]	6.698 [8.518]	3.2 [2.527]	24.52 [61.98]	−5.442*** [1.150]	0.00433*** [0.00498]	−5.277*** [2.034]	0.00511*** [0.0104]
Constant —cut 3	3.573*** [1.374]	35.62*** [48.94]	5.824** [2.690]	338.2** [909.8]	−4.065*** [1.128]	0.0172*** [0.0194]	−3.929* [2.010]	0.0197* [0.0395]
Constant —cut 4					−2.856** [1.113]	0.0575** [0.0640]	−2.486 [1.991]	0.0832 [0.166]
Observations	246	246	129	129	246	246	129	129

Note: Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE 4
ANOVA Measuring Nights of Reported Homework
and Student and Parent Grade Given to Sun Tech and Prior School

Variables	Sun Tech				Previous School			
	Student		Parent		Student		Parent	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
3 nights of HW	-0.315* [0.164]	0.730* [0.120]	-0.593** [0.272]	0.552** [0.150]	-0.722** [0.320]	0.486** [0.155]	-0.876* [0.454]	0.416* [0.189]
4 nights of HW	-0.347** [0.158]	0.707** [0.112]	-0.352 [0.248]	0.703 [0.174]	-0.166 [0.298]	0.847 [0.253]	-0.353 [0.381]	0.703 [0.268]
5 nights of HW	-0.175 [0.158]	0.839 [0.133]	-0.558** [0.246]	0.573** [0.141]	0.112 [0.251]	1.118 [0.281]	0.314 [0.350]	1.368 [0.479]
Father HS Grad	-0.157 [0.117]	0.855 [0.0996]	0.004 [0.180]	1.004 [0.181]	0.069 [0.215]	1.071 [0.230]	0.537* [0.302]	1.711* [0.517]
Father some college	-0.259* [0.138]	0.772* [0.107]	0.050 [0.182]	1.051 [0.192]	-0.301 [0.256]	0.740 [0.190]	0.323 [0.305]	1.381 [0.421]
Father college grad	-0.170 [0.192]	0.844 [0.162]	-0.004 [0.241]	0.996 [0.240]	-0.505 [0.354]	0.603 [0.214]	0.271 [0.405]	1.312 [0.531]
Mother HS Grad	-0.154 [0.136]	0.857 [0.117]	-0.360* [0.215]	0.698* [0.150]	-0.052 [0.253]	0.949 [0.240]	-0.101 [0.371]	0.904 [0.335]
Mother Some College	0.105 [0.150]	1.111 [0.166]	-0.149 [0.205]	0.862 [0.177]	-0.103 [0.280]	0.902 [0.253]	-0.424 [0.345]	0.654 [0.226]
Mother College Grad	0.129 [0.168]	1.138 [0.191]	0.085 [0.227]	1.088 [0.247]	-0.490 [0.307]	0.613 [0.188]	-0.834** [0.389]	0.434** [0.169]
Mother Help with HW	-0.134 [0.124]	0.875 [0.109]	0.103 [0.172]	1.108 [0.191]	0.160 [0.228]	1.174 [0.268]	0.727** [0.292]	2.069** [0.605]
Father Help with HW	0.081 [0.190]	1.084 [0.206]	-0.060 [0.242]	0.942 [0.228]	-0.035 [0.346]	0.966 [0.334]	-0.318 [0.386]	0.728 [0.281]
Other Help with HW	-0.100 [0.168]	0.905 [0.152]	-0.200 [0.242]	0.819 [0.198]	0.509 [0.312]	1.663 [0.520]	0.907** [0.408]	2.477** [1.010]
Race: White	0.100 [0.173]	1.105 [0.192]	-0.127 [0.284]	0.881 [0.250]	-0.459 [0.327]	0.632 [0.207]	0.147 [0.482]	1.158 [0.558]
Race: Hispanic	-0.052 [0.171]	0.949 [0.162]	-0.347 [0.270]	0.707 [0.191]	-0.162 [0.318]	0.850 [0.271]	-0.603 [0.447]	0.547 [0.245]
Race: Black	-0.310* [0.183]	0.733* [0.134]	-0.220 [0.272]	0.802 [0.218]	0.067 [0.341]	1.069 [0.365]	0.366 [0.471]	1.443 [0.680]
9th Grade	0.054 [0.154]	1.056 [0.163]	0.198 [0.216]	1.219 [0.264]	0.080 [0.287]	1.083 [0.311]	0.471 [0.366]	1.601 [0.586]
10th Grade	0.142 [0.157]	1.152 [0.181]	0.083 [0.223]	1.087 [0.242]	-0.518* [0.294]	0.595* [0.175]	-0.239 [0.382]	0.788 [0.301]
11th Grade	0.008 [0.148]	1.008 [0.149]	0.403* [0.218]	1.496* [0.327]	-0.442 [0.275]	0.643 [0.177]	-0.045 [0.370]	0.956 [0.354]
12th Grade	0.031 [0.156]	1.032 [0.161]	0.331 [0.223]	1.392 [0.311]	-0.120 [0.285]	0.887 [0.253]	-0.021 [0.375]	0.979 [0.367]
Gender: Male	0.114 [0.094]	1.121 [0.105]	0.218* [0.129]	1.244* [0.160]	-0.009 [0.175]	0.991 [0.173]	0.046 [0.216]	1.047 [0.227]
Observations	215	215	123	123	215	215	121	121
R ²	0.120	0.120	0.207	0.207	0.156	0.156	0.342	0.342

Note: Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE 5
ANOVA Measuring Nights of Reported Homework
and Student and Parent Satisfaction With Academic Quality at Sun Tech and Prior School

Variables	Achievement House				Previous School			
	Student		Parent		Student		Parent	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
3 nights of HW	0.164 [0.180]	1.178 [0.212]	0.414 [0.281]	1.513 [0.425]	0.693* [0.375]	1.999* [0.749]	-0.076 [0.475]	0.927 [0.441]
4 nights of HW	0.333* [0.173]	1.396* [0.242]	0.063 [0.258]	1.065 [0.275]	0.173 [0.346]	1.189 [0.412]	0.199 [0.399]	1.220 [0.486]
5 nights of HW	0.212 [0.173]	1.236 [0.214]	0.340 [0.254]	1.405 [0.357]	0.120 [0.292]	1.128 [0.329]	-0.727** [0.366]	0.483** [0.177]
Father HS grad	-0.012 [0.101]	0.988 [0.0996]	0.056 [0.134]	1.058 [0.142]	0.009 [0.206]	1.009 [0.208]	0.296 [0.226]	1.345 [0.303]
Father some college	0.047 [0.126]	1.048 [0.133]	0.109 [0.190]	1.115 [0.212]	-0.032 [0.253]	0.969 [0.245]	-0.522* [0.313]	0.594* [0.186]
Father college grad	-0.013 [0.149]	0.988 [0.147]	-0.260 [0.193]	0.771 [0.149]	-0.051 [0.301]	0.951 [0.286]	-0.306 [0.319]	0.736 [0.235]
Mother HS grad	-0.106 [0.202]	0.899 [0.182]	-0.064 [0.255]	0.938 [0.239]	0.182 [0.416]	1.200 [0.499]	-0.014 [0.424]	0.986 [0.418]
Mother some college	0.186 [0.144]	1.205 [0.174]	0.066 [0.223]	1.069 [0.238]	0.076 [0.293]	1.079 [0.316]	0.464 [0.379]	1.590 [0.604]
Mother college grad	0.088 [0.159]	1.092 [0.173]	0.020 [0.214]	1.020 [0.219]	0.058 [0.321]	1.059 [0.341]	0.563 [0.355]	1.756 [0.624]
Mother help w/HW	-0.136 [0.180]	0.873 [0.157]	0.027 [0.236]	1.028 [0.242]	0.710* [0.360]	2.035* [0.733]	1.040** [0.400]	2.828** [1.131]
Father help w/HW	-0.050 [0.134]	0.951 [0.127]	-0.220 [0.180]	0.803 [0.145]	-0.143 [0.270]	0.867 [0.234]	-1.166*** [0.306]	0.312*** [0.0954]
Other help w/HW	0.277 [0.202]	1.319 [0.267]	-0.074 [0.251]	0.928 [0.233]	0.256 [0.402]	1.292 [0.520]	0.824** [0.405]	2.281** [0.923]
Race: White	0.137 [0.179]	1.147 [0.206]	-0.090 [0.251]	0.914 [0.229]	-0.407 [0.362]	0.666 [0.241]	-1.045** [0.426]	0.352** [0.150]
Race: Hispanic	-0.092 [0.186]	0.913 [0.169]	-0.077 [0.296]	0.926 [0.274]	0.256 [0.380]	1.292 [0.491]	-0.282 [0.504]	0.754 [0.380]
Race: Black	0.226 [0.183]	1.254 [0.229]	0.050 [0.279]	1.051 [0.294]	0.234 [0.370]	1.264 [0.468]	0.319 [0.468]	1.376 [0.644]
9th Grade	0.190 [0.194]	1.209 [0.235]	-0.048 [0.281]	0.953 [0.268]	0.117 [0.396]	1.125 [0.445]	-0.586 [0.493]	0.556 [0.274]
10th Grade	0.021 [0.167]	1.021 [0.170]	0.008 [0.228]	1.008 [0.230]	-0.366 [0.338]	0.694 [0.235]	-0.618 [0.383]	0.539 [0.206]
11th Grade	-0.107 [0.173]	0.899 [0.155]	0.090 [0.237]	1.094 [0.259]	0.257 [0.350]	1.293 [0.453]	0.069 [0.398]	1.072 [0.426]
12th Grade	-0.139 [0.160]	0.870 [0.140]	-0.257 [0.231]	0.773 [0.179]	-0.055 [0.321]	0.946 [0.304]	0.078 [0.388]	1.081 [0.419]
Gender: Male	0.039 [0.169]	1.040 [0.176]	-0.259 [0.236]	0.772 [0.182]	-0.151 [0.334]	0.860 [0.288]	-0.173 [0.393]	0.841 [0.330]
Observations	211	211	121	121	208	208	122	122
R ²	0.094	0.094	0.168	0.168	0.092	0.092	0.353	0.353

Standard errors in brackets *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Finally (Table 6), an Ordinary Least Squares (OLS) regression was used to better measure the statistical effects of nights of homework on student and parent satisfaction with school academic quality, while assuming a linear relationship. We include the quadratic variable of nights of homework reported to

allow for nonlinearity of this variable in our model. Statistically significant findings existed only for parents when rating their student's previous school. In this case, parents rated their satisfaction with academic quality higher as the number of nights of homework increased. Their satisfaction was maximized at

TABLE 6
OLS Regression Measuring Nights of Reported Homework
and Satisfaction With School Quality Given to Sun Tech and Prior School

Variables	<i>Sun Tech</i>				<i>Previous School</i>			
	<i>Student</i>		<i>Parent</i>		<i>Student</i>		<i>Parent</i>	
	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>	<i>Coefficient</i>	<i>Odds Ratio</i>
Nights of HW	0.144 [0.171]	1.155 [0.197]	-0.167 [0.332]	0.846 [0.281]	0.436 [0.332]	1.546 [0.513]	1.235** [0.544]	3.439** [1.872]
Nights of HW ²	-0.015 [0.021]	0.985 [0.0205]	0.023 [0.038]	1.024 [0.0384]	-0.058 [0.041]	0.944 [0.0390]	-0.166** [0.064]	0.847** [0.0542]
Gender: Male	-0.047 [0.093]	0.954 [0.0890]	0.076 [0.132]	1.079 [0.142]	0.089 [0.186]	1.093 [0.203]	0.263 [0.214]	1.301 [0.278]
Mother's high level of ed.	-0.033 [0.046]	0.967 [0.0445]	-0.046 [0.066]	0.955 [0.0630]	0.246*** [0.090]	1.279*** [0.115]	0.299*** [0.108]	1.348*** [0.146]
Mother help with HW	0.045 [0.115]	1.047 [0.120]	-0.057 [0.165]	0.944 [0.156]	-0.316 [0.228]	0.729 [0.166]	-1.114*** [0.277]	0.328*** [0.0910]
Father help with HW	0.082 [0.182]	1.085 [0.198]	-0.213 [0.245]	0.808 [0.198]	0.389 [0.360]	1.475 [0.531]	0.897** [0.387]	2.452** [0.948]
Other help with HW	0.156 [0.168]	1.169 [0.197]	0.013 [0.249]	1.013 [0.252]	-0.241 [0.335]	0.786 [0.263]	-0.889** [0.429]	0.411** [0.176]
Race: White	-0.073 [0.158]	0.929 [0.147]	-0.173 [0.288]	0.841 [0.243]	0.269 [0.313]	1.308 [0.409]	-0.226 [0.478]	0.797 [0.381]
Race: Hispanic	0.186 [0.157]	1.204 [0.189]	0.196 [0.269]	1.217 [0.327]	0.128 [0.311]	1.136 [0.354]	0.105 [0.445]	1.110 [0.494]
Race: Black	0.172 [0.171]	1.187 [0.203]	-0.071 [0.276]	0.931 [0.257]	0.129 [0.339]	1.137 [0.386]	-0.549 [0.469]	0.577 [0.271]
9th Grade	0.044 [0.156]	1.045 [0.163]	0.087 [0.226]	1.091 [0.247]	-0.435 [0.314]	0.648 [0.203]	-0.488 [0.370]	0.614 [0.227]
10th Grade	-0.077 [0.161]	0.926 [0.149]	-0.041 [0.234]	0.960 [0.225]	0.221 [0.322]	1.248 [0.402]	0.164 [0.383]	1.179 [0.452]
11th Grade	-0.046 [0.149]	0.955 [0.143]	-0.269 [0.232]	0.764 [0.177]	-0.171 [0.298]	0.843 [0.251]	0.173 [0.382]	1.189 [0.455]
12th Grade	-0.000 [0.156]	1.000 [0.156]	-0.155 [0.234]	0.857 [0.201]	-0.167 [0.308]	0.846 [0.261]	-0.061 [0.383]	0.941 [0.361]
Constant	4.322*** [0.443]	75.30*** [33.36]	5.079*** [0.838]	160.6*** [134.6]	1.700** [0.808]	5.473** [4.420]	1.130 [1.219]	3.094 [3.773]
Observations	242	242	127	127	240	240	128	128
R ²	0.041	0.041	0.081	0.081	0.079	0.079	0.326	0.326

Note: Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3.72 nights of homework per week, which closely mirrors the maximization of homework when parents graded their school as well (see Table 4).

CONCLUSION

We must note that this has been an exploratory study of the impacts of homework within a single American cyber school, and with parent and student recall of their prior, traditional school. Replication using additional cases, a higher overall sample size, and additional nations would be highly desirable to establish the generalizability of findings. Additionally, more research is needed regarding the quality, and even the definition of homework in an online environment where most or all schoolwork is conducted at home or other nonschool settings. With that said, analyses indicate various possible relationships involving homework.

First, as student-reported homework increased, a student's grade point average (GPA) for that semester (Fall) increased; there was no statistically significant relationship between reported homework and Spring GPA. Second, parent-reported homework had a marginally significant positive association with Fall GPA, but unlike student-self report, an even stronger significant relationship with Spring GPA. This fits with a range of research indicating that more time on task leads to improved academic achievement (Chall, 2000; Lauer et al, 2006; Stinebrickner & Stinebrickner, 2008; Thernstrom & Thernstrom, 2003; Willingham, 2009). Additionally, students from single-parent families reported doing significantly less homework than their peers, in accord with research indicating that such families lack the resources for high levels of academic monitoring (Mayer, 1996). Similarly, we found that student-reports of fathers helping with homework significantly improved both short- and long-term GPA. In opposition to the current literature on homework (Cooper et al., 2006), our results did not confirm a rela-

tionship between amount of homework and the ratings (A through F) given Sun Tech. This may reflect our smaller sample size, as well as the inchoate definition of what homework actually looks like in a cyber school.

Second, for the students' prior brick-and-mortar school, parents rated satisfaction with the academic quality higher as the nights of homework increased. For parents, the relationship between nights of homework and satisfaction with academic quality of their child's prior school was far stronger than that for students. This could suggest that parents view homework in a conventional school setting as a mark of academic quality. In contrast, we found no such relationships in the cyber school, again, perhaps indicating the unclear character of homework in a cyber school, where the school space is the home space.

Future research should examine the definition, quantity, and quality of homework assigned to students in a cyber school and its impact on GPA and test scores (See Lemov, 2010 regarding the importance of quality in addition to quantity). The rapid growth of cyber schooling and the increased infusion of technology in brick-and-mortar schools make these issues more vital than ever.

In traditional school settings, homework takes considerable student time, a mean of nearly 200 hours a year for advanced American secondary students (Loveless, 2010) and even more in China (Tam & Chan, 2011). Given this significant investment, we need more research addressing its effectiveness both in traditional and cyber school settings. This study is a first attempt to explore the value-added from homework as regards grades, standardized test scores, and parent and student school satisfaction. We hope additional research will build on this foundation.

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