Online Appendix for:

Leveraging Parents through Low-Cost Technology: The Impact of High-Frequency Information on Student Achievement

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Abstract: This is the online appendix to accompany the paper to be published in the Journal of Human Resources. In this paper, we partnered a low-cost communication technology with school information systems to automate the gathering and provision of information on students' academic progress to parents of middle and high school students. We sent weekly, automated alerts to parents about their child's missed assignments, grades, and class absences. The alerts reduced course failures by 28%, increased class attendance by 12%, and increased student retention, though there was no impact on state test scores. There were larger effects for below-median GPA students and high school students. We sent over 32,000 messages at a variable cost of $63.

JEL Codes: I20, I21, I24, I28.

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Appendix A

Table A.1: Correlates of Communication

	Contact < 1x /3 mo.	Talk to Another Adult	Grade Inaccuracy	Child Discloses
Fraction Absent	-0.29	0.37	0.30	0.14
	(0.33)	(0.30)	(0.98)	(0.36)
Ever Suspended	0.12	-0.08	-0.06	-0.04
	(0.08)	(0.07)	(0.13)	(0.08)
GPA	0.03	0.01	-0.17***	-0.18***
	(0.03)	(0.025)	(0.06)	(0.02)
Black	0.03	-0.05	-0.014	-0.07
	(0.07)	(0.06)	(0.09)	(0.06)
IEP	-0.00	0.01	0.23	0.04
	(0.08)	(0.07)	(0.15)	(0.08)
Female	0.04	-0.08*	0.10	-0.05
	(0.05)	(0.05)	(0.08)	(0.05)
Two Parents	-0.03	0.18***	0.04	-0.08
	(0.06)	(0.06)	(0.09)	(0.05)
Parent Female	0.06	-0.01	-0.01	-0.00
	(0.05)	(0.05)	(0.09)	(0.05)
High School	-0.05	-0.04	0.12	-0.14***
	(0.05)	(0.04)	(0.09)	(0.05)
Control Mean	0.46	0.69	0.50	0.48
Observations	423	439	307	439

This table shows the correlates of several indicators of parental and student communication behavior. Standard errors clustered by student. All regressions include strata indicators. *** p<0.01, ** p<0.05, * p<0.10

Table A.2: Administrative Data on Alerts

	Alerted	Alerts	Assignment	Absence	Low Grade
Treated	0.705***	48.915***	21.612***	20.810***	6.458***
	(0.018)	(3.165)	(1.215)	(2.080)	(0.411)
Control Mean	0.021	0.375	0.058	0.006	0.056
Observations	1,137	1,137	1,137	1,137	1,137

This table shows the likelihood and amount of times parents are alerted due to being randomized into treatment. Alerts is the number of alerts received. Assignment, Absence, and Low Grade are the number of alerts received by parents by alert type. All regressions include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10.

Table A.3: School to Parent Contact about Child's Academic Progress

	$\geq$ 1x / month	2x / month.	1x / month	1x / 2-3 month	$<$ 1x / 3 month
Treatment	0.133**	0.044	0.089**	-0.049*	-0.084
	(0.055)	(0.049)	(0.041)	(0.027)	(0.051)
Control Mean	0.381	0.253	0.129	0.165	0.454
Observations	424	424	424	424	424

This table shows the intent-to-treat estimates for how often schools contacted parents in any way about their child's academic progress in the last semester. All regressions include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. The outcome variables are all from endline parent surveys. *** p<0.01, ** p<0.05, * p<0.10

Table A.4: Primary Academic Outcomes: Treatment-on-the-Treated Estimates

	Classes Failed	Classes Attended	Retained	Math Score	Reading Score
Alerted	-0.379***	48.465**	0.021**	-0.005	-0.076*
	(0.139)	(23.083)	(0.011)	(0.060)	(0.054)
Control Mean	0.974	277.700	0.973	0.000	0.000
Observations	1,113	1,137	1,137	927	925

This table shows treatment-on-the-treated (TOT) effect estimates on primary academic outcomes specified in the pre-registered analysis plan. Treatment effects are estimated using 2SLS regressions with the instrumented alerted variable, an indicator for parents who received at least one text. All regressions include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. Outcome variables are from gradebook and administrative data. Classes failed are total failed courses after treatment started. Classes attended is the numerical total of classes marked as present after treatment started. Retention is defined as taking courses one marking period after the intervention began. Math and Reading scores are z scores from standardized test scores. *** p<0.01, ** p<0.05, * p<0.10

Table A.5: Correlations with State Test Scores

	Math Score	Math Score	Reading Score	Reading Score
Baseline GPA	0.55***	0.75***	0.60***	0.86***
	(0.05)	(0.06)	(0.05)	(0.05)
Baseline GPA×High School		-0.32***		-0.42***
		(0.09)		(0.09)
Observations	927	927	925	925

This table shows the correlations between students' baseline GPAs and state math and reading test scores. Columns two and four interact the baseline GPA variable with an indicator for whether or not a student is in high school. Robust Standard errors in parentheses. GPA is constructed from gradebook data. *** p<0.01, ** p<0.05, * p<0.10

Table A.6: Robustness: Assignment Scores, Missed Assignments, Class Exams

Panel A.	Assignment Scores $< 2\sigma$	Class Exams $< 2\sigma$
Treatment	0.063***	0.094***
	(0.014)	(0.030)
Observations	67,032	7,043
Panel B.	Assignment Scores $< 4\sigma$	Class Exams $< 4\sigma$
Treatment	0.062***	0.86**
	(0.022)	(0.035)
Observations	71,063	7,407
Panel C.	Assignment Scores $< 5\sigma$	Class Exams $< 5\sigma$
Treatment	0.050**	0.074**
	(0.024)	(0.036)
Observations	71,512	7,439

This table shows treatment effects on student assignment scores and assignment completed with varying exclusion criteria for outliers. Panel A excludes all observation that are plus or minus two standard deviations from the mean. Panel B excludes all observation that are plus or minus four standard deviations from the mean. Panel C excludes all observation that are plus or minus five standard deviations from the mean. The estimates in the main text shows excludes outliers plus or minus three standard deviations from the mean. Effects are intent-to-treat estimates. All regressions include strata indicators and a set of demographic covariates described in the text. Outcome variables are calculated from the gradebook data. Assignment and exam scores are standardized according to the control group's score for each assignment or exam. There are multiple observations per student because there are multiple assignments or exams per student after the intervention began. Standard errors are clustered at the grade-school level. *** p<0.01, ** p<0.05, * p<0.10

Table A.7: Missed Assignments by subgroups

	Missed Assignments		
Sample	Low GPA	High School	Middle School
Treatment	-0.033**	-0.023*	0.004
	(0.015)	(0.012)	(0.011)
Control Mean	0.151	0.151	0.094
Observations	42,993	46,475	45,479

This table shows treatment effects on assignments completed for three different subgroups: column one shows results for students with below-median GPA, column two shows results for high school students, and column three shows results for middle school students. Effects are intent-to-treat estimates. Standard errors are clustered at the grade-school level. Outcome variables are calculated from the gradebook data. Missed assignments is an indicator for a missing assignment and include assignments and exams, including assignments marked "m" in the gradebook. There are multiple observations per student because there are multiple assignments or exams per student after the intervention began. *** p<0.01, ** p<0.05, * p<0.10

Table A.8: Alerts by Middle v. High School

	Alerted HS	Alerts HS	Alerted MS	Alerts MS
Treatment	0.705***	48.915***	0.694***	31.174***
	(0.018)	(3.165)	(0.024)	(2.287)
Control Mean	0.021	0.375	0.038	0.75
Observations	597	597	540	540

This table shows the likelihood and amount of times parents are alerted due to being randomized into treatment, where HS indicates students in high school and MS indicates students in middle school. Alerted is an indicator for ever alerted. Alerts is the number of alerts received. All regressions include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.9: Subgroup conditional on above-median absences at baseline

	Classes Failed	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.458**	26.895*	0.019*	0.048	0.009
	(0.209)	(17.742)	(0.015)	(0.063)	(0.067)
Control Mean	1.437	254.600	0.965	-0.279	-0.227
Observations	519	535	535	416	412

This table shows the results by subgroup of interest, in this case students who had above-median absences at baseline. Treatment effects are intent-to-treat estimates. All regression include strata indicators and a set of demographic covariates as described in the text. The p-values are for a test of whether the coefficient on the interaction term between the mother indicator and the treatment variable is equal to zero. Standard errors are clustered at the grade-school level. All regressions include strata indicators. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.10: Subgroup conditional on students who failed at least one course during baseline

	Classes Failed	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.719***	20.094	0.048***	0.031	0.052
	(0.244)	(20.764)	(0.019)	(0.056)	(0.069)
Control Mean	2.6658	308.200	0.957	-0.549	-0.655
Observations	353	368	368	273	272

This table shows the results by subgroup of interest, in this case students who failed at least one course during baseline. Treatment effects are intent-to-treat estimates. All regression include strata indicators and a set of demographic covariates as described in the text. The p-values are for a test of whether the coefficient on the interaction term between the mother indicator and the treatment variable is equal to zero. Standard errors are clustered at the grade-school level. All regressions include strata indicators. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.11: Effects by Baseline Parents Ever Logged in

Panel A. **Parents EVER logged during baseline**

	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.119	0.044	26.294	0.004	-0.097	0.095
	(0.114)	(0.069)	(19.864)	(0.017)	(0.063)	(0.073)
Control Mean	0.636	2.693	258.6	0.989	0.079	0.050
Observations	413	416	416	416	362	362

Panel B. **Parents NEVER logged during baseline**

	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.339**	0.088*	39.459**	0.020*	0.084*	-0.036
	(0.138)	(0.051)	(16.372)	(0.011)	(0.050)	(0.050)
Control Mean	1.169	2.500	288.4	0.964	-0.048	-0.030
Observations	700	721	721	721	565	563

This table shows the results by subgroups of interest, in this case students whose parents either logged in or did not log in to the parent portal at least once at baseline. Treatment effects intent-to-treat estimates. All regressions include strata indicators and a set of demographic covariates as described in the text. Standard errors are clustered at the grade-school level. All regressions include strata indicators. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.12: Subgroup of Below- and Above-Median Household Income

Panel A.	**Below-Median Household Income**					
	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.385***	0.117**	54.676***	-0.025*	-0.057	0.002
	(0.134)	(0.059)	(18.573)	(0.015)	(0.061)	(0.066)
Control Mean	1.190	2.488	253.0	0.966	-0.064	-0.117
Observations	549	563	563	563	455	453
Panel B.	**Above-Median Household Income**					
	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.094	0.002	10.437	-0.012	0.039	-0.075
	(0.138)	(0.071)	(17.388)	(0.008)	(0.054)	(0.050)
Control Mean	0.799	2.719	298.1	0.979	0.0520	0.0950
Observations	564	574	574	574	472	472

This table shows the results by subgroups of interest, in this case students whose household income at the census tract level is below or above the median for Kanawha County. Treatment effects are intent-to-treat estimates. All regression include strata indicators and a set of demographic covariates as described in the text. Standard errors are clustered at the grade-school level. All regressions include strata indicators. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.13: Subgroup of Below- and Above-Median Proportion Households with minimum Bachelors Degree

Panel A.	**Below-Median Education**					
	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.432***	0.126*	44.527**	-0.018	-0.010	0.022
	(0.158)	(0.069)	(17.750)	(0.016)	(0.065)	(0.068)
Control Mean	1.227	2.424	253.1	0.967	-0.183	-0.206
Observations	543	558	558	558	446	444
Panel B.	**Above-Median Education**					
	Classes Failed	GPA	Classes Attended	Retained	Math Score	Reading Score
Treatment	-0.186	0.046	26.118	-0.012	-0.038	-0.093
	(0.117)	(0.059)	(20.448)	(0.011)	(0.055)	(0.060)
Control Mean	0.748	2.788	299.9	0.978	0.160	0.178
Observations	570	579	579	579	481	481

This table shows the results by subgroups of interest, in this case students whose household's highest education is bachelors or higher at the census tract level is below or above the median for Kanawha County. Treatment effects are intent-to-treat estimates. All regression include strata indicators and a set of demographic covariates as described in the text. Standard errors are clustered at the grade-school level. All regressions include strata indicators. Outcome variables are from gradebook and administrative data. *** p<0.01, ** p<0.05, * p<0.10

Table A.14: Academic Outcomes: Year 2

Panel A.	**Entire Year 2 Sample**			
	Classes Failed	Classes Attended	Retained	GPA
Treatment	-0.284**	33.725*	0.018**	0.049
	(0.111)	(17.622)	(0.009)	(0.050)
Observations	1,009	1,032	1,032	1,032
Panel B.	**High School**			
	Classes Failed	Classes Attended	Retained	GPA
Treatment	-0.585**	29.500	0.039	0.154*
	(0.192)	(24.550)	(0.016)	(0.077)
Observations	440	492	492	492
Panel C.	**Middle School**			
	Classes Failed	Classes Attended	Retained	GPA
Treatment	-0.039	35.613	-0.004	-0.053
	(0.110)	(24.475)	(0.007)	(0.064)
Observations	532	540	540	540
Panel D.	**Below-Median GPA**			
	Classes Failed	Classes Attended	Retained	GPA
Treatment	-0.683***	44.163**	0.035*	0.170
	(0.200)	(19.869)	(0.015)	(0.077)
Observations	498	514	514	514

This table shows intent-to-treat effect estimates on academic outcomes during the second year of the intervention. All regressions include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. Outcome variables are from gradebook data. Classes failed are total failed courses during the 2016-2017 academic year. Classes attended is the number of total of classes marked as present during the 2016-2017 academic year. Retention is defined as taking courses during the 2016-2017 academic year. The sample size is smaller than the Year 1 sample because Year 1 12th-grade students graduated. *** p<0.01, ** p<0.05, * p<0.10

Table A.15: Spillover Effects

	Classes Failed	Classes Attended	Retained	GPA
Treated Grade	0.056	18.635	0.008	-0.026
	(0.077)	(21.310)	(0.010)	(0.041)
Observations	9,226	9,709	9,709	9,709

This table shows treatment effects on academic outcomes for those students who were not part of the randomization process, and therefore were not treated. The Treated Grade variable is an indicator for students who were in the same grade and school as students who were treated. All regressions and outcomes are constructed as described in the text for those who were randomized, and therefore include strata indicators and a set of demographic covariates described in the text. Standard errors are clustered at the grade-school level. Outcome variables are from gradebook data. *** p<0.01, ** p<0.05, * p<0.10

Table A.16: Participation Grades and Excused Assignments

	Participation	Excused
Alerted	-0.041	0.002
	(0.048)	(0.005)
Observations	4,932	80,643

This table shows treatment effects on participation grades and excused assignments. Column one shows the effects on participation grades, which is an indicator for receiving a full mark on participation grades in the gradebook. Column two shows the effects on an indicator for an assignment being marked by the teacher as "excused." Effects are intent-to-treat estimates. All regressions include strata indicators and a set of demographic covariates described in the text. Outcome variables are calculated from the gradebook data. There are multiple observations per student because there are multiple scores per student after the intervention began. Standard errors are clustered at the grade-school level. *** p<0.01, ** p<0.05, * p<0.10

Appendix B

Table B.1: Primary outcomes and their sources

Outcome	Source
Number of failed courses	Administrative Data
Number of classes present	Administrative Data
Retention	Administrative Data
Math scores	Administrative Data
English scores	Administrative Data

Table B.2: Primary outcomes and their construction

Outcome	Construction
Number of failed courses	Total number of 2nd semester courses with an F
Number of classes present	Total number of classes marked either present or tardy after the intervention began
Retention	Indicator for whether a student took 2nd semester courses
Math scores	Math scores standardized by control group mean and standard deviation by grade
English scores	English scores standardized by control group mean and standard deviation by grade

Table B.3: Primary outcomes and hypothesized effect

Outcome	Test
Number of failed courses	ATE>0
Number of classes present	ATE>0
Retention	ATE>0
Math scores	ATE>0
English scores	ATE>0

Table B.4: Secondary outcomes and their sources

Outcome	Source
Number of alerts sent	Administrative Data
Number of parent logins	Administrative Data
Number of student logins	Administrative Data
Ever suspended	Administrative Data
GPA	Administrative Data
Total number of missed assignments	Administrative Data
School-to-parent contact	Survey Q3
Parent-to-school contact	Survey Q6
Accuracy of grade beliefs	Survey Q9 & Admin Data
Accuracy of missed assignment beliefs	Survey Q16 & Admin Data
Parent talks to child about schoolwork	Survey Q12
Parent takes privileges from child over schoolwork	Survey Q14
Desire to continue intervention	Survey Q19

Table B.5: Secondary outcomes and their construction

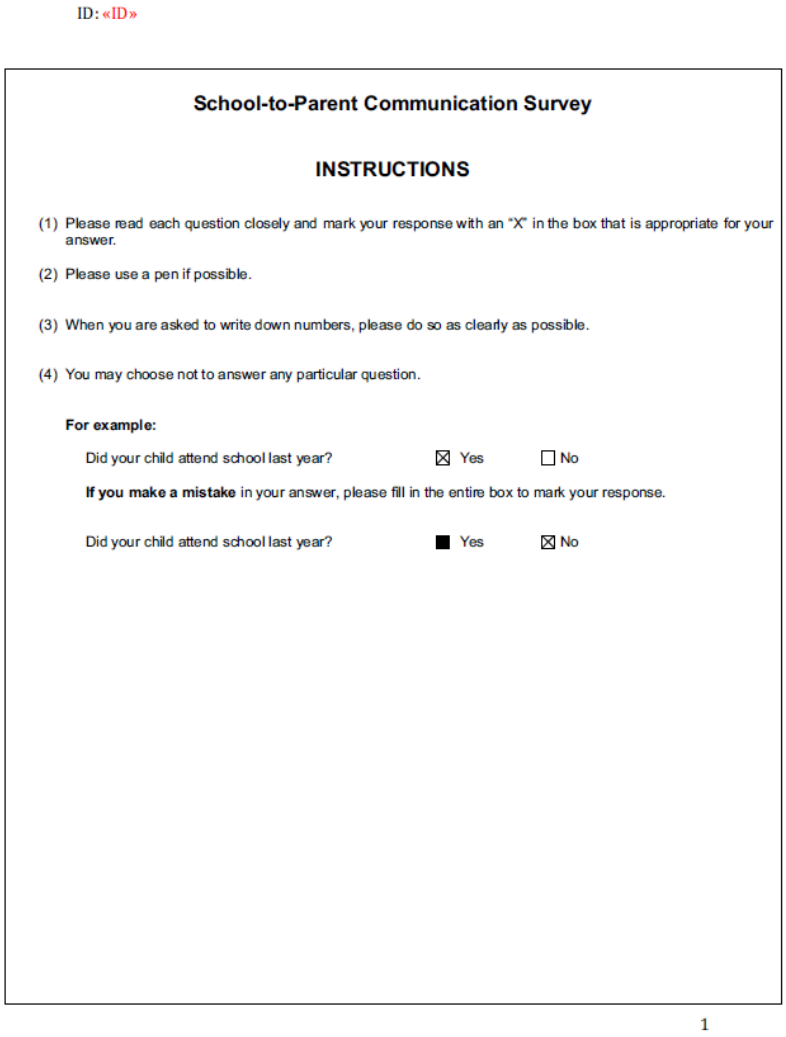
Outcome	Construction
Number of alerts sent	Total alerts sent post intervention start
Number of parent logins	Total parent logins post intervention start
Number of student logins	Total student logins post intervention start
Ever suspended	Indicator for a suspension of any length occurring post intervention start
GPA	Average of 2nd semester grades using a 4-point scale imputing zeros for missing.
Total number of missed assignments	Total number of assignments missed in the 2nd semester
School-to-parent contact	Indicator for once per month or greater
Parent-to-school contact	Indicator for above median contact
Accuracy of grade beliefs	Survey Q9 minus grade from last report card and indicator for "I don't know"
Accuracy of missed assignment beliefs	Survey Q16 minus number from 2nd semester data and indicator for "I don't know"
Parent talks to child about schoolwork	Indicator for 2-3 times per week and above.
Parent takes privileges from child over schoolwork	Indicator for true or not
Desire to continue intervention	Indicator for true or not

Table B.6: Secondary outcomes and hypothesized effect

Outcome	Test
Number of alerts sent	ATE> 0
Number of parent logins	ATE!=0
Number of student logins	ATE!=0
Ever suspended	ATE< 0
GPA	ATE> 0
Total number of missed assignments	ATE< 0
School-to-parent contact	ATE!=0
Parent-to-school contact	ATE!=0
Accuracy of grade beliefs	ATE> 0
Accuracy of missed assignment beliefs	ATE> 0
Parent talks to child about schoolwork	ATE!=0
Parent takes privileges from child over schoolwork	ATE!=0
Desire to continue intervention	ATE> 0

Appendix C

Figure C.1: Endline Survey Letter



ID: «ID»

School-to-Parent Communication Survey

INSTRUCTIONS

(1) Please read each question closely and mark your response with an "X" in the box that is appropriate for your answer.

(2) Please use a pen if possible.

(3) When you are asked to write down numbers, please do so as clearly as possible.

(4) You may choose not to answer any particular question.

For example:

Did your child attend school last year? ☒ Yes ☐ No

If you make a mistake in your answer, please fill in the entire box to mark your response.

Did your child attend school last year? ■ Yes ☒ No

1

This is page 1 of 4 of the endline survey letter sent to participant parents after the end of the treatment school year.

Figure C.2: Endline Survey Letter

ID: «ID»

This survey pertains *only* to «child_name»

1. What is your relationship with «child_name»?

Please mark one

☐ Mother ☐ Father ☐ Grandparent ☐ Aunt or uncle ☐ Brother or sister ☐ Other guardian

2. Would you say that you are primarily in charge of monitoring «child_name»'s academic progress?

Please mark one

☐ Yes ☐ No

3. How often does the school contact you by letter, phone, text message or email about «child_name» grades or absences?

Please mark one

☐ About twice a month ☐ About once a month ☐ Once every two or three months ☐ Less than once every three months

4. Please tell us if you agree with the following: "The school makes it easy for me to help «child_name» get good grades in school."

Please mark one

☐ Agree ☐ Disagree

5. Is it difficult to be involved in «child_name»'s education because he/she does not tell you enough about his/her work or grades?

Please mark one

☐ Yes ☐ No

6. Since January 1st, how many times did you call, email, or visit the school to talk about «child_name»'s schoolwork or grades?

Please mark one

☐ None ☐ Once ☐ Twice ☐ Three times ☐ Four times ☐ Five times ☐ More than five times

7. Since January 1st, how many report cards have you received?

Please mark one

☐ None ☐ One ☐ Two ☐ Three ☐ Four ☐ Five or more

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This is page 2 of 4 of the endline survey letter sent to participant parents after the end of the treatment school year.

Figure C.3: Endline Survey Letter

ID: «ID»

8. **Since January 1st, how many report cards have you received?**
Please mark one

☐ None ☐ One ☐ Two ☐ Three ☐ Four ☐ Five or more

9. **Since January 1st, how many times is your school *supposed* to send you a report card?**
Please mark one

☐ None ☐ One ☐ Two ☐ Three ☐ Four ☐ Five or more

10. **On «child_name»'s last report card, what was his/her grade in math class?**
Please mark one

☐ A ☐ B ☐ C ☐ D ☐ F ☐ I don't know

11. **Compared to other students in «child_name»'s grade, would you say his/her grade in math is above or below average?**
Please mark one

☐ Above average ☐ About average ☐ Below average

12. **During the last month of school, approximately how many *days* of school has «child_name» missed due to excused or unexcused absences?**
Provide a number that is your best guess.

_____

13. **During the last month of school, how many times did you talk to «child_name» about their schoolwork or grades?**
Please mark one

☐ Once or twice last month ☐ About once a week ☐ 2-3 times a week ☐ Every day

14. **During the last month of school, how many times did you talk to *another adult* in the household about «child_name»'s schoolwork or grades?**
Please mark one

☐ Never ☐ Once or twice last month ☐ About once a week ☐ 2-3 times a week or more

3

This is page 3 of 4 of the endline survey letter sent to participant parents after the end of the treatment school year.

Figure C.4: Endline Survey Letter

ID: «ID»

15. **During the last month of school, did you or another adult in the household take away privileges from «child_name» for not doing all of his/her schoolwork?**
Please mark one

☐ Yes ☐ No

16. **Are you primarily in charge of «child_name»'s discipline?**
Please mark one

☐ Yes ☐ No

17. **How many assignments would you guess «child_name» missed this semester?**
Please mark one

☐ None ☐ Between one and five ☐ Between six and ten ☐ More than ten

18. **Have you heard of the Promise Scholarship in West Virginia?**
Please mark one

☐ Yes ☐ No

19. **Do you know what GPA is required to be eligible for the Promise Scholarship? If not, provide your best guess.**
Please mark one and complete the required field

☐ Yes
Required GPA: _____

☐ No
Best guess of required GPA: _____

20. **If your school started or continued a texting service to inform you about «child_name»'s academic progress, would you use it?**
Please mark one

☐ Yes ☐ No

21. **If you answered yes to the previous question, how many times per month would you like to receive such information?**
Please provide a number

_____

22. **What is the highest level of education you completed?**
Please mark one

☐ Did not complete high school ☐ Completed high school ☐ Some college ☐ Completed college ☐ More than college

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This is page 4 of 4 of the endline survey letter sent to participant parents after the end of the treatment school year.