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Are California's Schools Ready for
Online Testing and Learning?

Technical Appendices

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Appendix A: Data

The 2014 CAASPP Survey

The 2014 CAASPP Field Test Survey was a statewide survey designed and conducted by the California Educational Technology Professionals Association (CETPA) to gauge districts' technology readiness. CETPA's Board of Directors developed the survey questions, after sharing information with county level IT directors across California. The survey was then sent out to CETPA members, who are primarily IT support professionals working in California public schools, including but are not limited to Chief Technology Officers, Directors of Technology, Network Managers, Technicians and other instructional support professionals. The initial survey was sent out in April (during the test window) and included about 30 questions and the follow-up survey was done in August and included 9 additional questions. Most of these questions are close-formed questions. Both surveys were sent out electronically and CETPA kept the window open for three to four weeks to maximize response rate. A complete list of questions can be found on the [CETPA website](#).

Sample Selection

More than 480 districts and county offices of education submitted their responses electronically. After dropping districts with incomplete responses (N=101), county offices of education¹ (N=20) and private schools (N=2), my final sample includes 362 unique districts. One hundred and twelve districts responded to both surveys and in case of inconsistent responses, which is rare, I used their answers in August survey. This decision was made after talking with CETPA staff: the May survey was conducted during the test window so some districts thought they would have enough capacity but at the conclusion of the test realized that they actually did not.

Reliability and Validity

The survey was designed and answered by IT professionals who have sufficient knowledge about districts' technology infrastructure and the administration of online testing, so it is reasonable to believe that the respondents understand and answer these questions accurately and reflectively. While this survey was not field tested, CETPA's board of directors shared the information with and solicited input from technology directors at the county level. To encourage more in-depth responses, each close-form question is followed by an open-form "comment."² As a conclusion, while there are still concerns on the survey's reliability and validity, it is reasonable to believe that the responses are credible.

¹ County offices of education were asked to answer the questions based on their OWN schools, i.e., students enrolled with their COE taking the test. Since majorities of these students are of special educational needs, I excluded county offices of education for this analysis.

² It should be noted that very few districts responded to these comments, which are important because they provide context for their responses.

Appendix B: Analysis of Survey Respondents

Table B1 summarizes district characteristics by survey participation. Clearly, large and urban districts are overrepresented in the survey. Respondents also have slightly better performances, as measured by percentages of students scoring at or above proficiency in state standardized tests. Current expenditure is roughly 15 percent lower in participating districts; however, there is no marked difference in capital outlay spending. Median household income is the same; however average property value is about 25 percent higher in participating districts, which is reasonable since these districts are concentrated in large, urban areas. Finally, participating districts tend to have faster internet connection (Figure B1) and more classrooms in these districts are connected with internet.

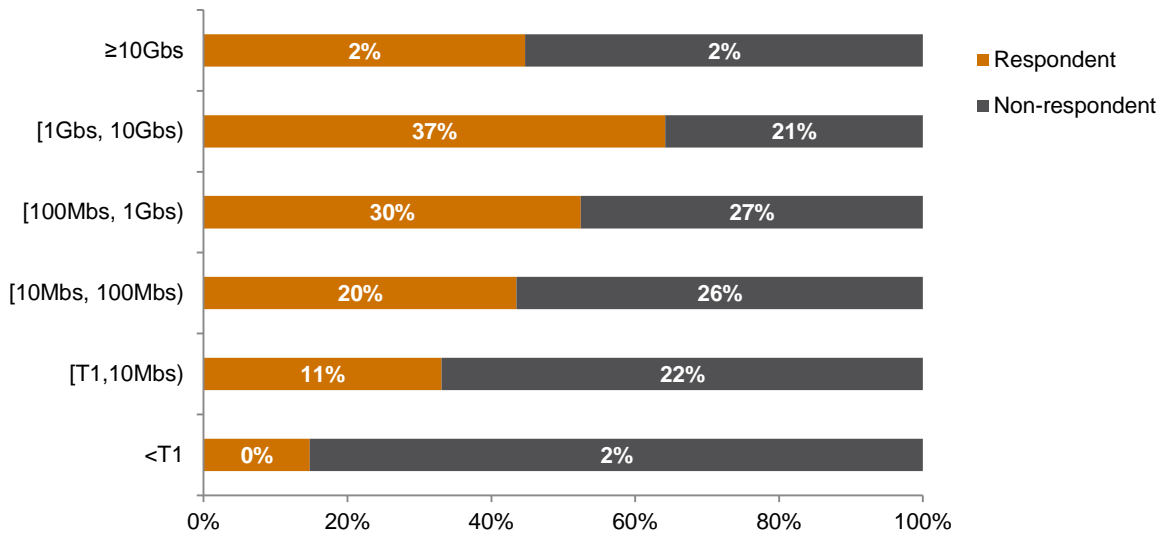
TABLE B1
Analysis of respondents

	Respondent	Non-respondent
Urban	23%***	15%
Rural	20%***	49%
Total Enrollment	11381***	3220
% FRPM	44%	47%
% EL	20%	21%
% White	36%***	44%
% Proficient or above - Math	62%***	55%
% Proficient or above - ELA	60%***	54%
Current expense (per pupil)	7770***	9178
Capital Outlay (per pupil)	886	1021
Median household income	64944	61178
Average property value (in the past 3 years)	434238***	345922
Number of computers (per student)	0.21**	0.25
Percent of classroom connected with Internet	96%**	94%
Number of districts	362	668

SOURCES: (1) Participation status: 2014 CETPA survey. (2) Enrollment and Hispanic: California Department of Education, 2013 †4. (3) Urbanicity: Common Core of Data, National Center for Education Statistics, 2011 †2. (4) Median household income: U.S. Census, 2012. (5) Average property value: Trulia, 2012 – 2014. (6) English learners: California Department of Education, 2013–14. (7). Free/reduced meal: California Department of Education, 2012 †3. (8). % proficient: SACS, California Department of Education, 2012–13. (9) Current expense: California Department of Education, 2012 †3. (10) Capital outlay: National Center for Education Statistics, 2010–11. (11) Number of computers and classrooms with Internet: California Department of Education, 2013–14.

*** p<0.01, ** p<0.05, * p<0.1.

FIGURE B1
Connection speed in districts, by survey participation



NOTE: Difference between respondents and non-respondent significant at 1% level.

Appendix C: Construction of Dependent Variables

Specific questions used to construct each infrastructure component are:

Hardware:

Sufficient quantity of desktops for devices for all students to take the test
Specifications/quality of hardware you have available to take the field test

Network:

The sufficiency of your bandwidth for the traffic during the test window
The reliability of your network to successfully handle the field test traffic

Software:

The installation and/or reliability of the secure browser required for the test
Potential challenges with the distribution of IDs and quick log-ins

Staffing:

Sufficient quantity of staff to provide technical support
Sufficient training for instructional staff to prepare for giving the assessment
Sufficient training for the support staff and assessment technicians

Descriptive Summary of Outcome Variables

Responses to survey questions are coded as follows:

3 if the response was “sufficient”

2 if the response was “unsure” and

1 if the response was “insufficient.” A descriptive summary of outcome variables are presented in Table C1.³

TABLE C1
Descriptive summary of dependent variables

IT infrastructure	N	Missing	Mean	SD	min	max
Hardware	361	1	5.39	1.16	2	6
Network	360	2	5.42	1.19	2	6
Software	361	1	4.94	1.28	2	6
Staffing	357	5	6.71	2.12	3	9

³ Alternative coding (e.g., lumping “unsure” and “insufficient” together) does not change the conclusion qualitatively.

Appendix D: Detailed Model Estimates

Table D1 shows the impact of multiple factors on districts’ readiness status. The estimates are based on an OLS regression with each readiness component as the dependent variable. The preferred model, as shown in Table D1, includes county fixed effects. Alternative specifications, as shown in Table D2, yield qualitatively similar results. In addition, the same conclusion holds if we choose a limited dependent variable model as Probit. These results are available upon request.

TABLE D1
Factors explaining the variations in technology readiness across districts

	Hardware	Software	Network	Staffing
Total enrollment (in 000)	0.0013 [0.001]	-0.0028*** [0.001]	-0.0005 [0.001]	-0.0022 [0.002]
Locality: urban	-0.1814 [0.213]	-0.0961 [0.294]	0.0252 [0.200]	-0.5038 [0.490]
Locality: rural	-0.3056 [0.204]	-0.3451 [0.207]	-0.3131 [0.274]	-0.0569 [0.382]
Number of computers (per pupil)	0.7045** [0.296]	0.4931 [0.374]	0.3413 [0.313]	0.8935 [0.775]
Percent of classrooms connected to Internet	0.0048 [0.009]	0.0063 [0.005]	0.0085 [0.007]	-0.0024 [0.011]
% Hispanic	-0.0023 [0.005]	-0.0003 [0.009]	0.0018 [0.007]	-0.0231* [0.013]
% FRPM	-0.0029 [0.003]	-0.0013 [0.004]	-0.0013 [0.004]	-0.0005 [0.006]
% EL	-0.0019 [0.011]	-0.012 [0.010]	-0.0025 [0.010]	0.0175 [0.013]
% at or above proficiency - Math	0.0055 [0.007]	-0.0049 [0.011]	0.01 [0.012]	-0.01 [0.018]
Spending on equipment (per pupil) (in 000)	2.4903 [3.802]	8.7172** [3.369]	3.3292 [4.287]	16.0960*** [4.823]
Constant	4.9234*** [0.827]	4.1922*** [1.135]	3.8873*** [1.224]	9.4755*** [1.874]
Observations	345	345	344	341
R-squared	0.202	0.163	0.234	0.254

SOURCES: (1) Readiness items: 2014 CETPA survey. (2) Enrollment and Hispanic: California Department of Education, 2013–14. (3) Urbanicity: Common Core of Data, National Center for Education Statistics, 2011–12. (4) Median household income: U.S. Census, 2012. (5) Average property value: Trulia, 2014. (6) English learners: California Department of Education, 2013–14. (7). Free/reduced meal: California Department of Education, 2012–13. (8). % proficient: SACS, California Department of Education, 2012–13. (9) Per pupil spending on instructional equipment: National Center for Education Statistics, 2010–11. (10) Number of computers and percent of classrooms connected: California Department of Education, 2013–14.

NOTES: (1) Standard errors in brackets and clustered at county level. (2) *** p<0.01, ** p<0.05, * p<0.1.

Table D2 shows the point estimates based on different model specifications. The estimates are stable across scenarios and I reported results based on model (6). Results for other dependent variables, such as network, software and staffing are qualitatively similar and are available upon request.

TABLE D2
Alternative specifications: The impact of multiple factors on technology readiness (hardware)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total enrollment (in 000)	0.0011* [0.001]	0.0011 [0.001]	0.0011 [0.001]	0.0008 [0.001]	0.0008 [0.001]	0.0013 [0.001]	0.0017*** [0.001]	0.0015* [0.001]
Locality: urban		-0.1754 [0.159]	-0.1659 [0.174]	-0.1489 [0.157]	-0.1504 [0.163]	-0.1814 [0.213]	-0.0876 [0.249]	-0.1879 [0.221]
Locality: rural		-0.3528* [0.177]	-0.3568** [0.154]	-0.3128* [0.163]	-0.3045* [0.166]	-0.3056 [0.204]	0.2015 [0.227]	-0.3408 [0.233]
Number of computers (per pupil)			0.7857*** [0.231]	0.7749*** [0.244]	0.7629*** [0.246]	0.7045** [0.296]	0.6962 [0.692]	0.7210** [0.305]
Percent of classrooms connected to Internet			0.008 [0.007]	0.0086 [0.007]	0.0085 [0.007]	0.0048 [0.009]	-0.0168* [0.010]	0.0002 [0.009]
% Hispanic				0.0004 [0.004]	0.0003 [0.004]	-0.0023 [0.005]	-0.0042 [0.016]	-0.0003 [0.005]
% FRPM				-0.0045* [0.003]	-0.0043 [0.003]	-0.0029 [0.003]	0.0143*** [0.005]	-0.0009 [0.004]
% EL				-0.0015 [0.008]	-0.0013 [0.008]	-0.0019 [0.011]	0.0156 [0.022]	0.0001 [0.012]
% at or above proficiency - Math				0.0037 [0.006]	0.0041 [0.006]	0.0055 [0.007]	0.0287 [0.027]	0.0141 [0.009]
Spending on equipment (per pupil) (in 000)					1.8499 [3.909]	2.4903 [3.802]	7.0332** [2.690]	2.2441 [3.911]
Median household income (in 000)							0.0001 [0.014]	
Average property value (in 000)								0.0001 [0.000]
Constant	5.3742*** [0.058]	5.4854*** [0.063]	4.5542*** [0.665]	4.3642*** [0.624]	4.3223*** [0.628]	4.9234*** [0.827]	4.5632 [2.749]	4.5316*** [1.132]
County Fixed Effects						√	√	√
Observations	349	349	349	346	345	345	133	325
R-squared	0.001	0.017	0.044	0.063	0.063	0.202	0.271	0.183

SOURCES: (1) Readiness items: 2014 CETPA survey. (2) Enrollment and Hispanic: California Department of Education, 2013–14. (3) Urbanicity: Common Core of Data, National Center for Education Statistics, 2011–12. (4) Median household income: U.S. Census, 2012. (5) Average property value: Trulia, 2014. (6) English learners: California Department of Education, 2013–14. (7). Free/reduced meal: California Department of Education, 2012–13. (8). % proficient: SACS, California Department of Education, 2012–13. (9) Per pupil spending on instructional equipment: National Center for Education Statistics, 2010–11. (10) Number of computers and percent of classrooms connected: California Department of Education, 2013–14.

NOTE: (1) Standard errors in brackets and clustered at county level. (2) *** p<0.01, ** p<0.05, * p<0.1.

Appendix E: Factors Affecting Bandwidth

Table E1 summarizes the impact of multiple factors on districts' connectivity. They are based on an OLS regression with bandwidth as the dependent variable. My preferred model is Model (7) which includes county fixed effects. Multi-nomial logit yields qualitatively similar results and are available upon request.

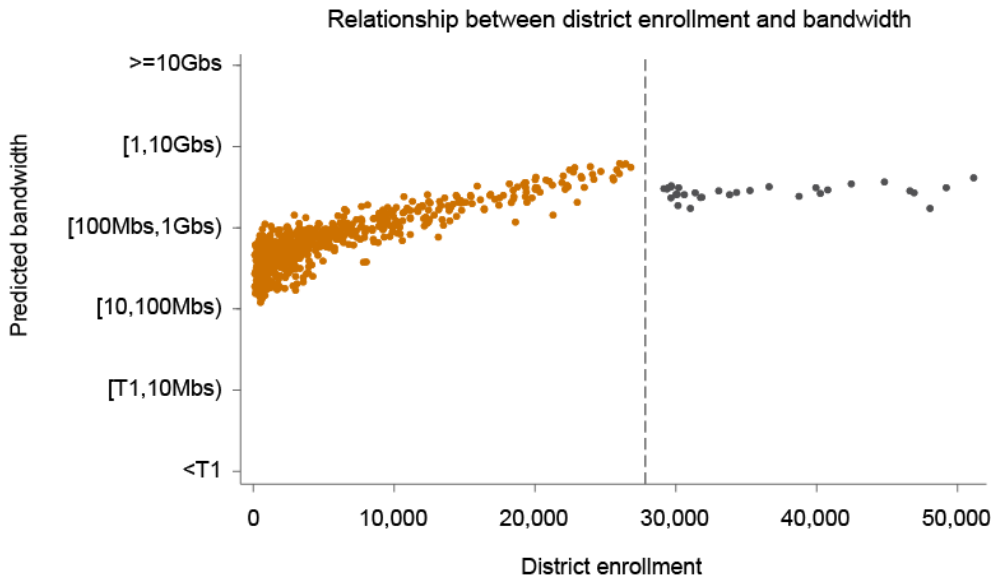
TABLE E1
Impact of multiple factors on districts' connectivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total enrollment (in 000)	3.91E-05***	2.78E-05***	2.76E-05***	2.66E-05***	2.76E-05***	2.37E-05***	7.47E-05***
Total enrollment squared (in 000,000)	-5.64E-11***	-3.91E-11***	-3.89E-11***	-3.72E-11***	-3.88E-11***	-3.31E-11***	-1.34E-09***
Urbanicity: city		0.7611***	0.7762***	0.6574***	0.7675***	0.5867***	0.2928**
Urbanicity: suburban		0.5844***	0.6025***	0.4752***	0.5847***	0.3755***	0.2837**
Urbanicity: town		0.6953***	0.6962***	0.5887***	0.6915***	0.5442***	0.4650***
Per pupil spending, capital outlay					-0.0185	-0.0112	0.0198
% Hispanic						0.0043	0.0070**
% Black						-0.0018	0.0107
% FRPM						0.003	-0.002
% LEP						-0.0043	-0.0019
% at or above proficiency (Math)						0.0079*	0.0085
Median household income			-0.0005				
Average property value				-0.0003			
Constant	3.2480***	3.0108***	3.0339***	3.1293***	3.0251***	2.4988***	2.4729***
County FE							X
Observations	760	760	759	660	760	680	680
R-squared	0.177	0.22	0.221	0.179	0.22	0.173	0.37

SOURCES: (1) Bandwidth: K12HSN, 2014. (2) Enrollment and Hispanic: California Department of Education, 2013–14. (3) Urbanicity: Common Core of Data, National Center for Education Statistics, 2011–12. (4) Median household income: U.S. Census, 2012. (5) Average property value: Trulia, 2014. (6) English learners: California Department of Education, 2013–14. (7). Free/reduced meal: California Department of Education, 2012–13. (8). % proficient: SACS, California Department of Education, 2012–13. (9) Per pupil spending on instructional equipment: National Center for Education Statistics, 2010–11.

NOTES: (1) Standard errors in brackets and clustered at county level. (2) *** p<0.01, ** p<0.05, * p<0.1. (3). Sample excludes districts with usually high level of capital outlay expenditure. Since the data are unaudited, I excluded them from the analysis. (4). Sample excludes districts with enrollment at or above 99th percentile. Since there are only 8 of them, and they have the notorious effects of tilting the regression line, I excluded them from the analysis. Estimates including these districts yield qualitatively similar results.

FIGURE E1
Impact of student enrollment on districts' connectivity



SOURCES: (1) Bandwidth data: DataLINK, K-12 High-Speed Network (K12HSN), 2014. (2) District enrollment data: California Department of Education, 2013–14. (3) Enrollment and Hispanic: California Department of Education, 2013–14. (4) Urbanicity: Common Core of Data, National Center for Education Statistics, 2011–12. (5) Median household income: U.S. Census, 2012. (6) Average property value: Trulia, 2014. (7) English learners: California Department of Education, 2013–14. (8) Free/reduced meal: California Department of Education, 2012–13. (9) % proficient: SACS, California Department of Education, 2012–13. (9) Per pupil spending on instructional equipment: National Center for Education Statistics, 2010-11.

NOTES: (1). LA unified enrolls more than 600,000 students and it has the notorious effect of tilting the regression line, I thus exclude LA from the analysis. (2) Estimates are taken from a linear regression of bandwidth on a variety of characteristics including district enrollment, district urbanicity; median household income; district spending, student composition, student need, student performance and county fixed effects. Standard errors adjusted for clustering at county level. Please refer to Appendix Table E1 for a detailed discussion of model specification. (3). Sample excludes districts with unusually high level of per-pupil capital outlay spending. Since the capital outlay data are unaudited, I excluded them from the analysis. (4). Sample also excludes districts with enrollment above the 99 percentile (53250 students or more). Since there are only 8 of them and they have the notorious effect of tilting the regression line, I excluded them from the analysis. Including these districts do not change the conclusion qualitatively, but brings the tipping point, which is 27,824 in this figure, to 383,785. (5). The inverse u-shaped curve is identified as follows: first run a quadratic regression and identify the point at which the u-shape maxes out; then run a linear regression up to the tipping point (27,824) and another from that point on wards. The second line is negative and significant at 1% level.

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