Digital Writing Across the Curriculum

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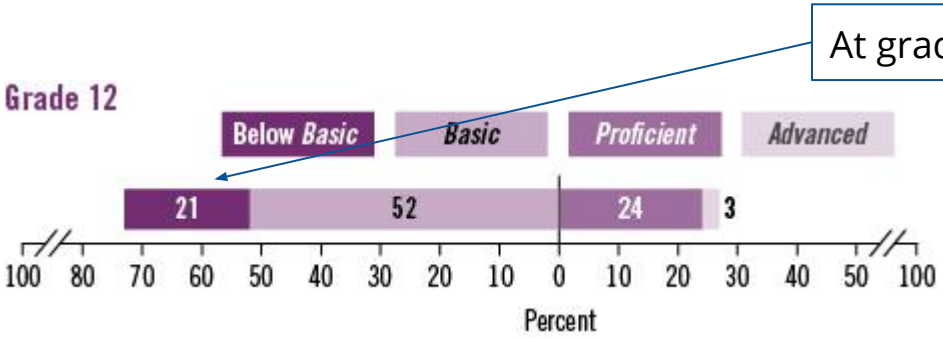
Why this project?

- Writing is critical in today's information economy
- Students are weak writers
- More writing => Better writers!
- Much of today's serious (and not so serious) writing is done digitally



SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Writing Assessment.

Our questions

- How much **time** do students spend writing digitally?
  - What sort of variations are there? Do the variations relate to school, grade, access to digital devices, demographics?
  - How does time spent writing digitally change over time?
- How does time spent writing digitally relate to writing achievement on standardized English language arts benchmark assessments?

Our data

- **Digital writing time:** Partnered with Hapara.com to gather information from school district Google domain of how much time students spent writing in Google docs across the curriculum
  - No access to actual texts written
- **Demographics & achievement:** School districts linked anonymized Hapara data with de-identified school records to provide us some demographic information and achievement data
- **Digital device access:** School districts either provided us with the number of devices at each school over the time period (which we converted to a device per student variable) or the 1:1 technology roll out schedule (which we converted to a variable representing years of 1:1 access)

Our students

- Grades 4-11
  - Not all data available for all grades, for example, in one district only students in grades 4-8 and grade 11 had ELA scores on the annual state assessment
  - Districts provided different demographic data (e.g., one district would not disclose ethnicity only a dichotomous “student of color” variable)

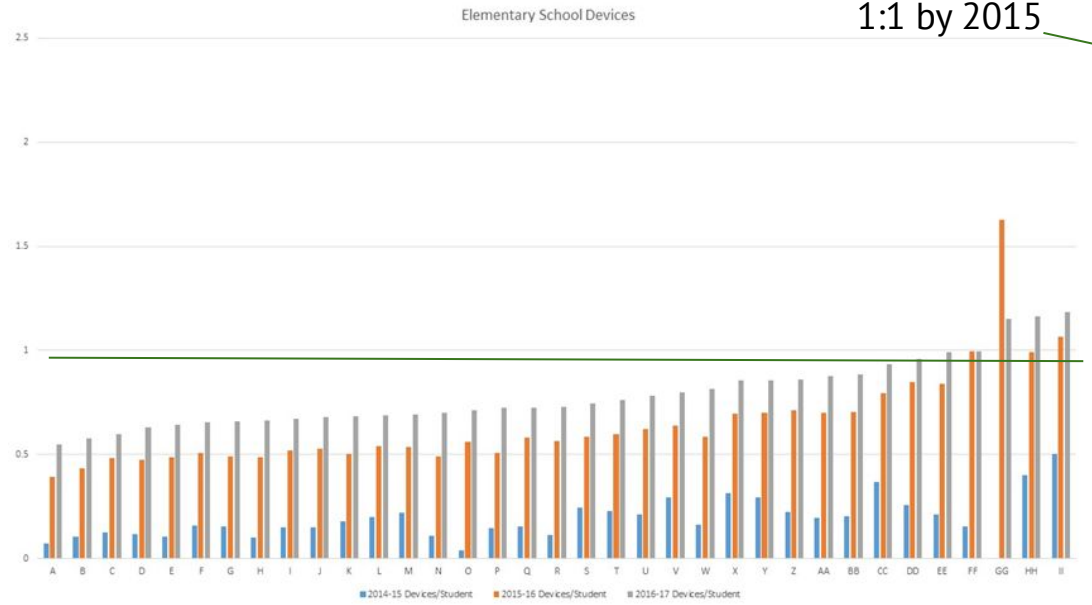
	SUD Analytic Sample	SUD Population (all grades)	MSD Analytic Sample	MSD Population (all grades)
Total students (#)	28,200	54,500	16,600	39,400
Male	50%	50%	51%	51%
English learners	32%	40%	5%	8%
Free/reduced lunch	93%	87%	NA	46%
Hispanic/Latino	NA	93%	NA	13%

Our schools

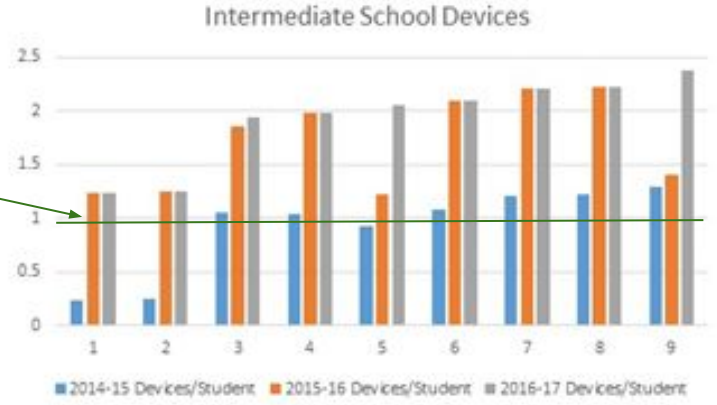
- Two very different school districts and technology access
  - **SUD**: Southwestern, urban, predominately Hispanic and qualifying for free/reduced lunch, large number of English learners; digital devices deployed as funds became available over the period, largely school-driven deployment rather than district-directed
  - **MSD:** Midwestern, suburban, more affluent, few English learners; systematic district-driven 1:1 technology roll out with pilot schools, then adoption across grade levels at all schools simultaneously

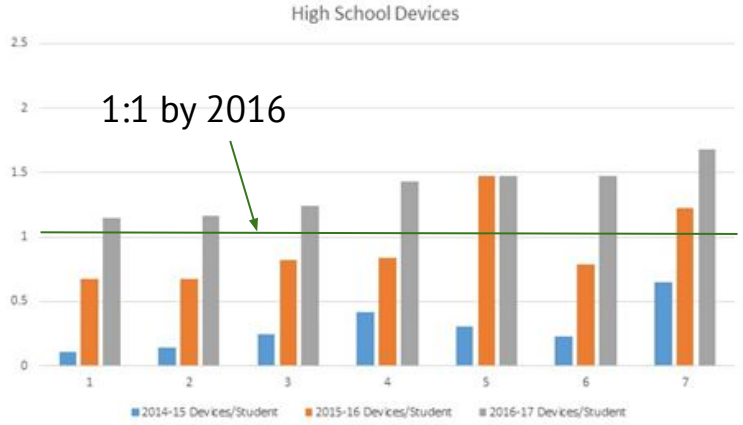
Today's focus

SUD digital device access



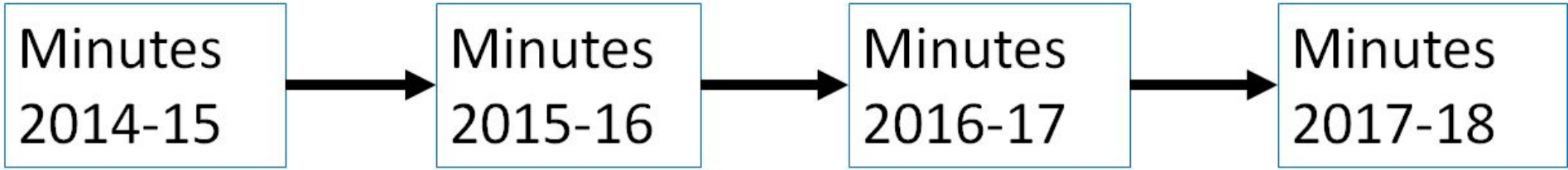
1:1 by 2015





Our hypothesis

- The number of minutes of digital writing in the prior year will predict the next year's number of minutes
  - Devices in place set a minimum level of access
  - Teacher, curriculum set a minimum level of usage

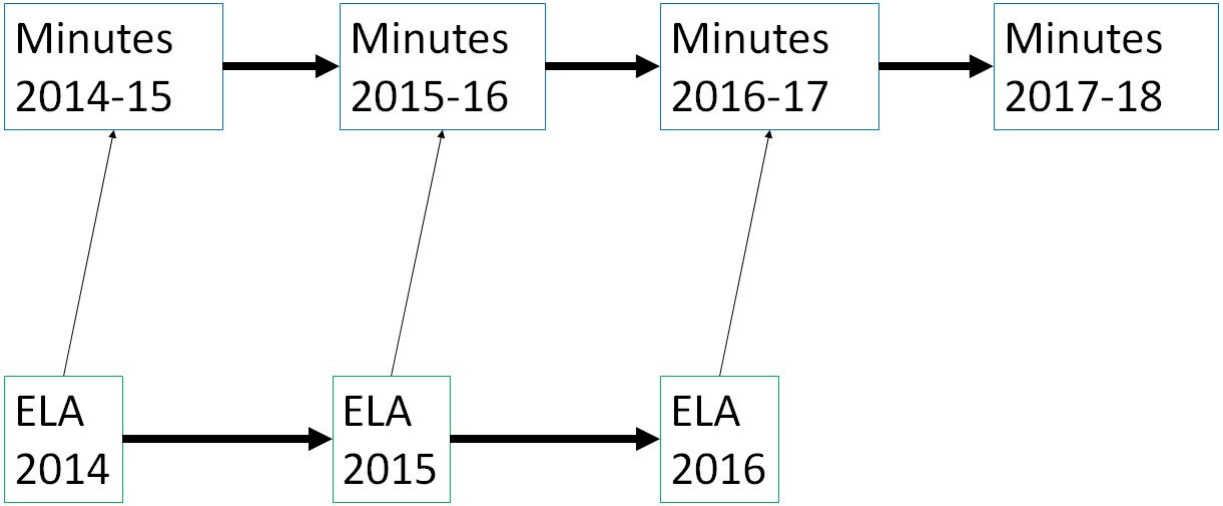


Our hypothesis

- Research tells us that the prior year's ELA score will be highly predictive of the next year's ELA score

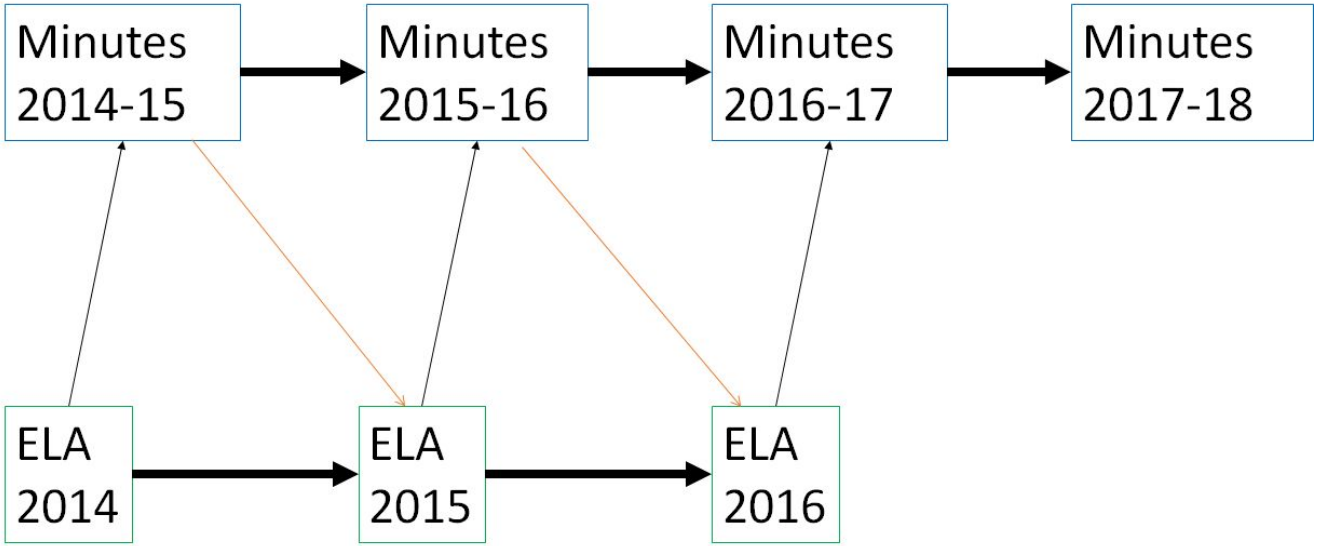
Our hypothesis

- The prior year's ELA score is somewhat representative of the student's overall literacy skills coming into the new school year, so it is used as a control for their fluency level in some models



Our hypothesis

- We hypothesize that increased minutes of digital writing will predict improved end of the year ELA scores

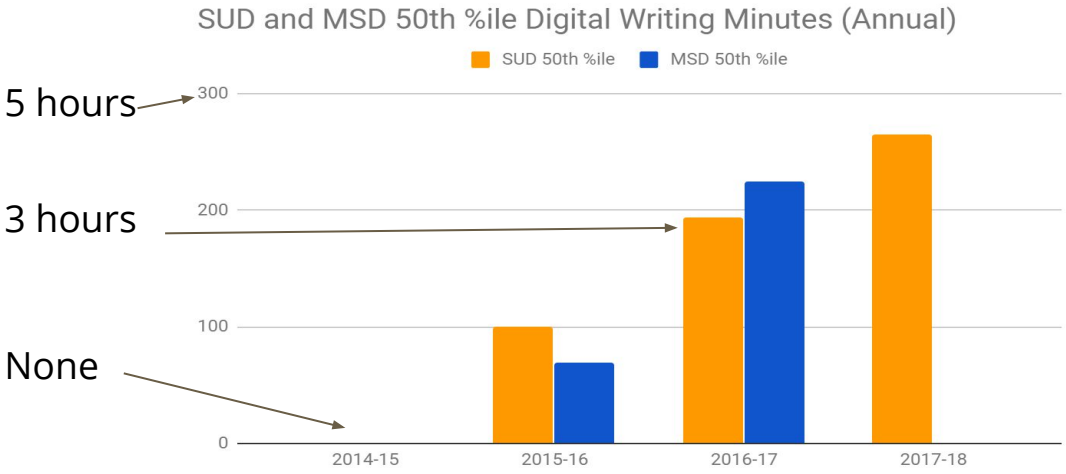


Analytical approach

- Descriptive data, including by school, grade, over time
- Fixed effects regression to determine if device access or digital writing time predicted ELA achievement scores on standardized tests
  - Fixed effects controlling for schools to remove school-level confounding variables
- Structural equation models: SUD only
  - Stata, using maximum likelihood with missing values
  - Group contrasts (males/females, etc.) with Wald test to determine if variance between groups was significant

Results--descriptive

- Students are writing on computers **3-4** hours a year in *all classes total*
- The amount is growing rapidly



Results--descriptive

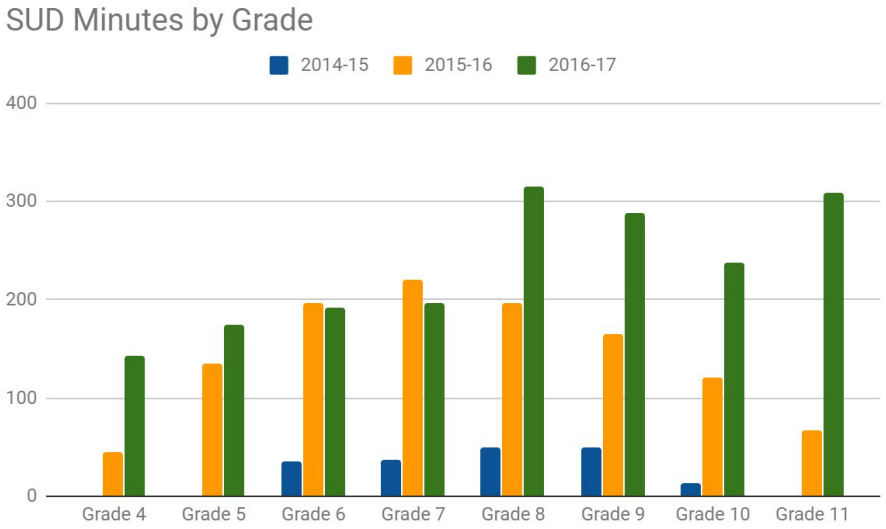
1:1 grades
4/5/6/7, 2 High

MSD annual digital writing minutes

	2012-13	2013-14	2014-15	2015-16	2016-17
1%ile	0	0	0	0	0
5%ile	0	0	0	0	0
10%ile	0	0	0	0	0
25%ile	0	0	0	0	1.81
50%ile	0	0	0	69.42	224.94
75%ile	1.54	39.23	133.33	338.16	620.43
90%ile	120.35	210.87	321.68	691.80	1095.13
95%ile	215.07	312.62	455.03	1009.73	1433.28
99%ile	424.23	567.98	868.35	1789.12	2223.67

Results--descriptive

Grade level variations

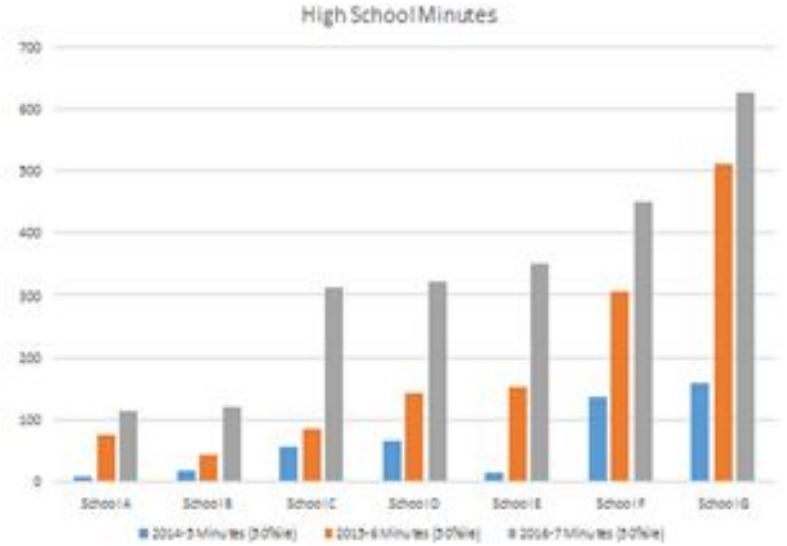


SUD annual digital writing minutes

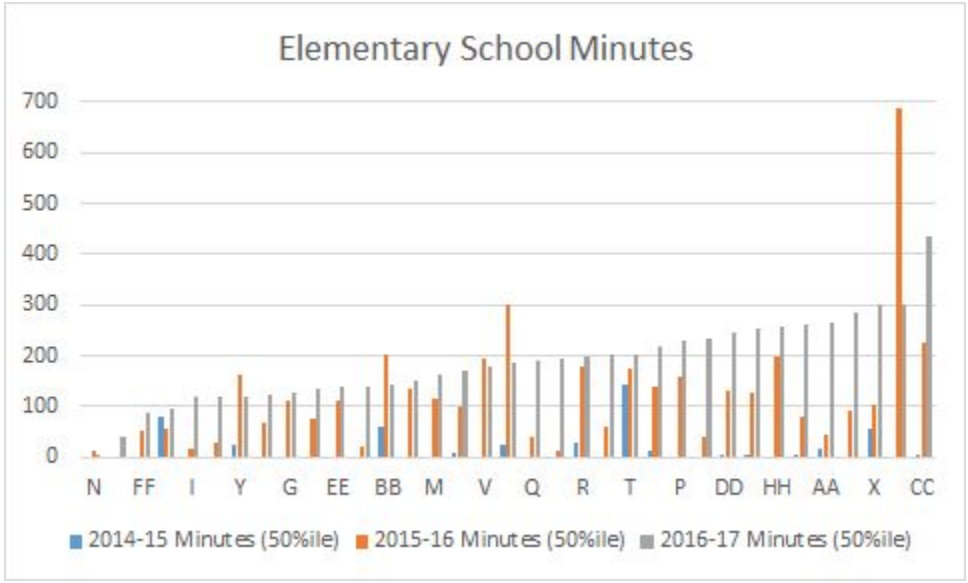
	2014-15	2015-16	2016-17	2017-18
1%ile	0	0	0	0
5%ile	0	0	0	0
10%ile	0	0	0	22.82
25%ile	0	.08	55.73	108.75
50%ile	0	100.62	194.25	264.60
75%ile	61.9	282.05	404.42	547.62
90%ile	172.78	557.58	699.10	933.67
95%ile	256.13	785.43	935.57	1230.68
99%ile	460.18	1286.37	1562.83	1897.08

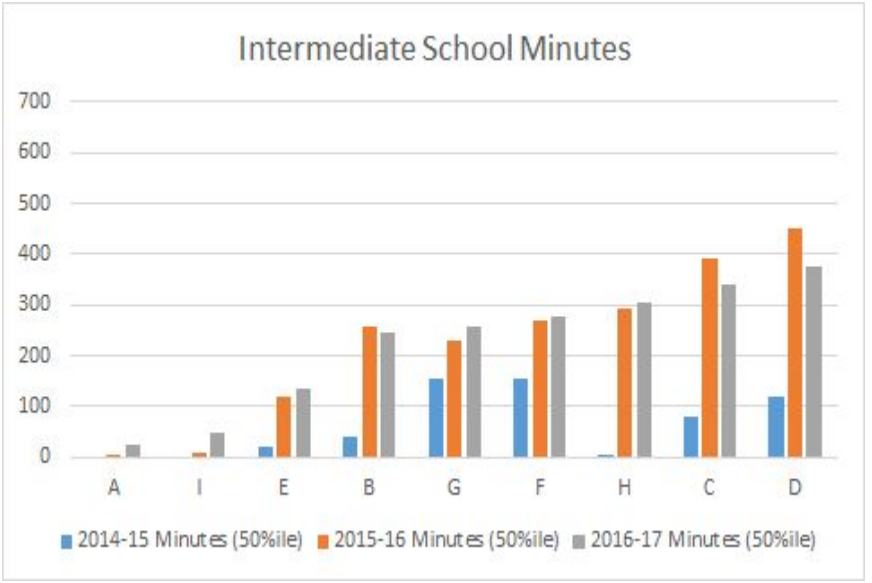
Results--descriptive

- **In SUD, we see school-level variations in the 50th percentile digital minutes**



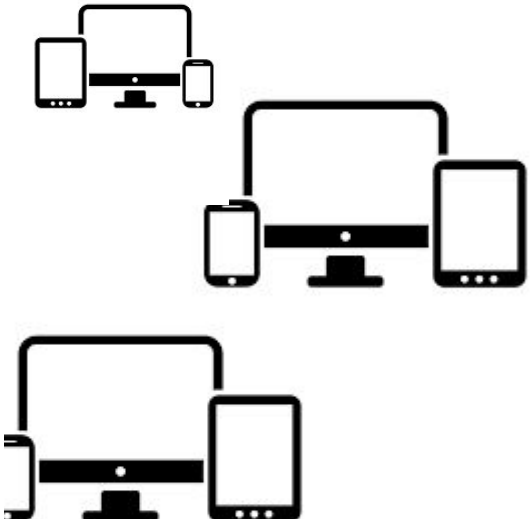
Results--descriptive, school-level variation





Results--fixed effects regressions

- More devices per student predicts the number of writing minutes initially



Results--fixed effects regressions

- Grade level is not predictive of writing minutes
- Gender (male), Limited English proficiency, and special education status predict lower number of minutes
- Identification as gifted predicts higher number

Results--fixed effects regressions

- No significant interactions between device density and demographic controls in SUD
- In MSD additional time with 1:1 access led to increased digital writing minutes for:
  - males (.18, $p < .001$)
  - English learners (.25, $p < .05$)
  - students in special education (.25, $p < .05$; all 2016-17).

Minutes of Digital Writing

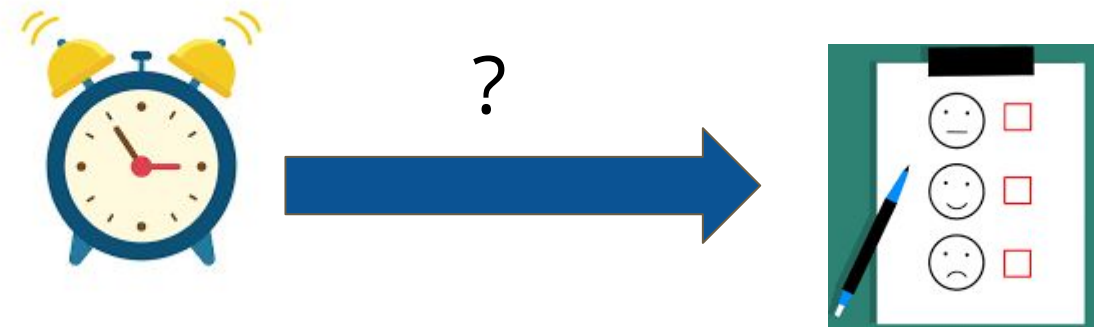
	2014-15		2015-16		2016-217	
	MSD	SUD	MSD	SUD	MSD	SUD
Device density	**4.35*** **	**0.35***	**0.67*** **	**0.20***	**-0.07**	**0.18**
	-0.08	-0.15	-0.06	-0.09	-0.11	-0.11
Prior ELA score	na	0.10**	na	0.21***	na	0.28***
		-0.03		-0.04		-0.04
Male	-0.13***	-0.07***	0.26***	-0.07***	-0.51***	-0.15**
	-0.03	-0.02	-0.06	-0.02	-0.08	-0.05
English learner	-0.23*	0.00	-0.36*	0.03	-0.73***	0.04
	-0.1	-0.03	-0.16	-0.02	-0.18	-0.03
Gifted	0.34***	0.02	0.32	-0.06	0.34	-0.12*
	-0.06	-0.04	-0.23	-0.06	-0.27	-0.04
Special education	-0.18***	-0.09	0.33***	0.02	-0.72**	0.01
	-0.04	-0.08	-0.08	-0.03	-0.22	-0.04
Male x density	-0.55***	-0.05	-0.36***	-0.06**	0.18***	0.00
	-0.03	-0.03	-0.05	-0.02	-0.04	-0.03
Eng learner x density	-1.39***	-0.07*	0.15	-0.11***	0.25*	-0.04
	-0.12	-0.03	-0.09	-0.03	-0.1	-0.04
Gifted x density	1.62***	0.07	0.22	-0.02	0.09	0.06*
	-0.37	-0.07	-0.15	-0.08	-0.13	-0.03
SpEd x density	-0.75***	0.04	-0.47***	0.00	0.25*	0.01
	-0.05	-0.07	-0.07	-0.04	-0.11	-0.04

Device density predicts the number of writing minutes in earlier years

Selected data shown; all controls, interactions, and school fixed effects model

Does digital writing time predict ELA achievement?

- SUD
  - Not when we controlled for prior year ELA score
  - With school-level fixed effects, all controls and interactions, but **no** prior year ELA score
    - 2015 was .03*
    - 2016 was .12*



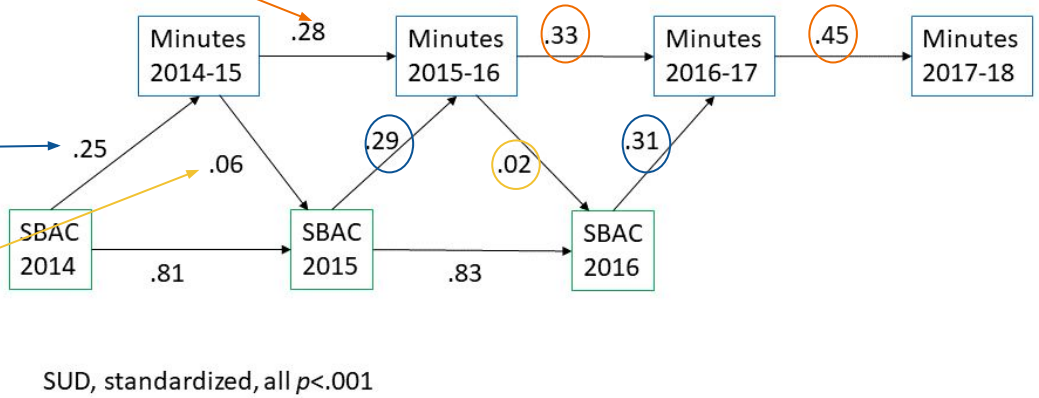
Does digital writing time predict ELA achievement?

- MSD
  - With school-level fixed effects, all controls and interactions, but no prior year ELA score
  - Selected results:

	2014-15		2015-16	
	Reading	Writing	Reading	Writing
Annual minutes	**0.13*** **	**0.20*** **	**0.15*** **	**0.45*** **
Male x minutes	0.04**	0.00	0.03**	0.02
EL x minutes	-0.16*	0.27	-0.17**	0.18
Gifted x minutes	-0.08***	-0.07***	-0.09***	-0.14**

Results--SEM, SUD

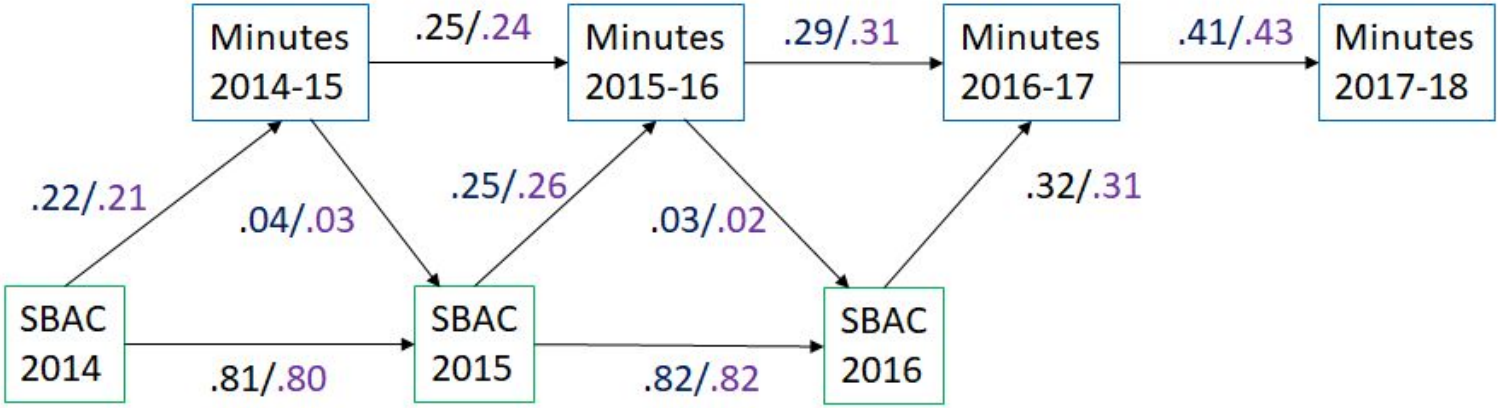
- Digital writing minutes in prior year predict the number of minutes in the subsequent year
- ELA scores predicted the amount of digital writing done in the **subsequent** year
- *Digital writing minutes predict a small increase in end of the year ELA score*



SUD, standardized, all $p<.001$

Results--SEM, SUD by groups

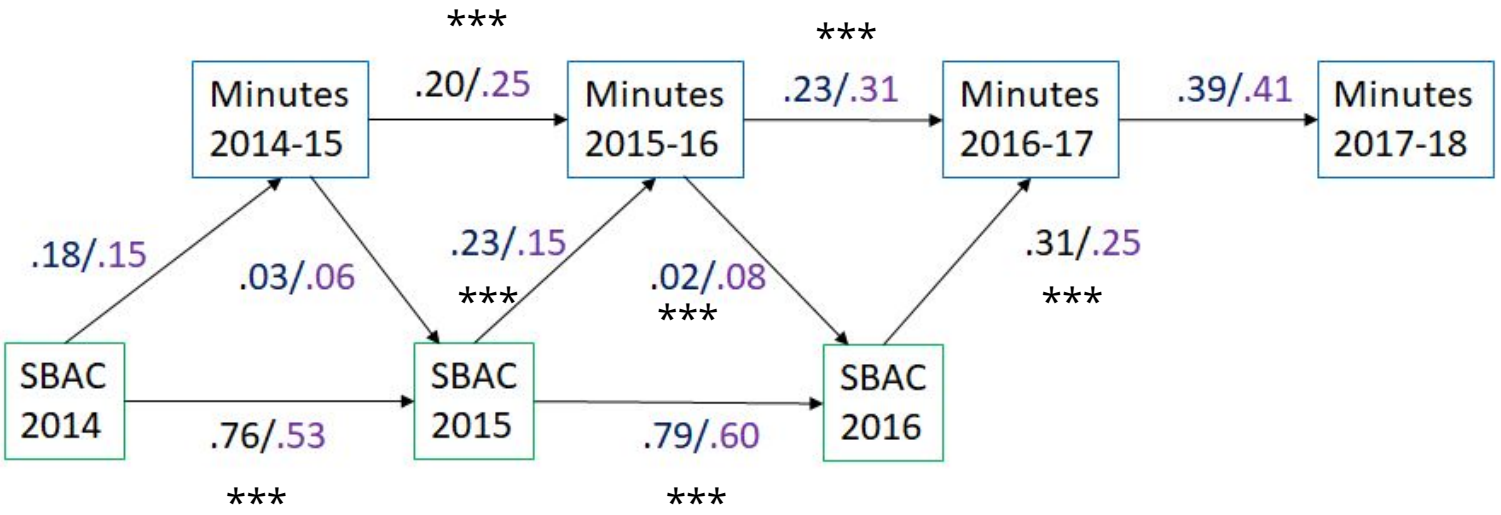
Female/Male



SUD, standardized, all $p<.001$

Results--SEM, SUD by groups

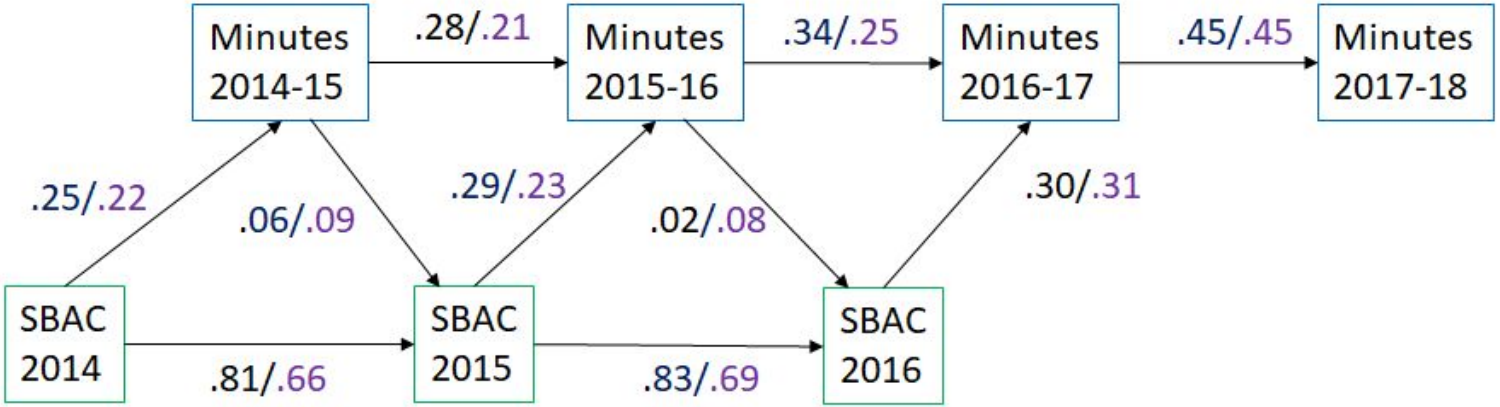
English Proficient/Limited English Proficient



SUD, standardized, all $p<.001$ Wald test: *** indicates $p<.001$

Results--SEM, SUD by groups

General Education/Special Education



SUD, standardized, all $p<.001$

Key findings

- Students write very little digitally across the curriculum
- Access to devices does matter, up to a point
- There is a lot of variation over time, by grade level, and by school
- More proficient students spend more time writing digitally than less proficient students (analogous to findings with respect to writing by hand)
- Increased digital writing time may predict slightly improved achievement scores--it's not decreasing scores. There's reason to be hopeful that it is slightly more beneficial for students with limited English proficiency and in special education

Final thoughts

- Even in 2017-18, there were students who did *no* digital writing or less than half an hour during the entire year
- Equity component: ensure all students are proficient at digital writing; also may help reduce some achievement gaps
- As access to devices improves across schools and districts, we would expect to see continued increases in digital writing minutes as the teachers and curriculum adjust
- This doesn't need to be all in English language arts; increased attention to writing across the disciplines is a critical part of improve students' writing.

Next steps

- Look closer at the *quality* of the writing and instruction in these grades:
  - With WRITE Center data from other districts that includes full text, analysis of features of effective secondary school ELA and history writing looking at data from Cohmetrix & LIWC, analytical coding of a subset of essays, and holistic essay scores
  - Observation of classroom practices
- Improve the teaching and learning of academic writing

Thank You!

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