Examining Implementation of a Tablet-based Algebra Program within a Randomized Control Trial

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Introduction.

- This poster examines the implementation of a tablet-based algebra program within the context of a randomized control trial (RCT). We compared outcomes for students using the print textbook (control group) to students using the tablet-based algebra application that contains the content of the control text plus interactive lessons, explanations, quizzes, and 300+ videos (program group).
- We found no average impact on middle school students' algebra achievement across four participating districts.
- However one participating district (Creek Bend) initiated its own investigation of available data and found what appeared to be a strong impact. As an exploratory measure, we then assessed the impact for this district and also found a strong impact.
- This poster examines the hypothesis that the impact was a result of strong implementation.

Methods.

- The original experiment was a comparison of outcomes for classes where the tablet-based program was in place and classes using the print edition of the text. We randomly assigned one algebra period for each participating teacher to the program condition and each teacher's remaining algebra sections formed the control group.
- Each teacher block represents a mini-experiment, allowing us to assess both impact and implementation level per block.
- We ran additional exploratory analyses examining the nature of implementation associated with impacts of the program to assess whether level of implementation has a positive association with impact.

Data Sources.

- Teacher surveys: Teachers completed surveys on a monthly basis in order to characterize classroom implementation. Questions covered time spent instructing with the tablet, time students spent using the tablet, and number of algebra videos watched in class.
- Student surveys: Students completed a seven-item survey after each of the 11 chapters. Questions covered the number of videos watched and amount of time spent doing algebra.
- Log data: We collected log data from student devices. Data provided records of the number of times individual students used distinct features of the application.
- California Standards Test (CST): Algebra scores

Impact of Tablet-based Program.

Overall sample: There was no impact on performance on the CST ($p = .52$).
Riverside: The impact of the treatment on CST performance in Riverside was 11.95 scale score units ($p = .01$).
Non-Riverside: The impact for the sample excluding Riverside was -0.28 scale score units ($p = .95$).
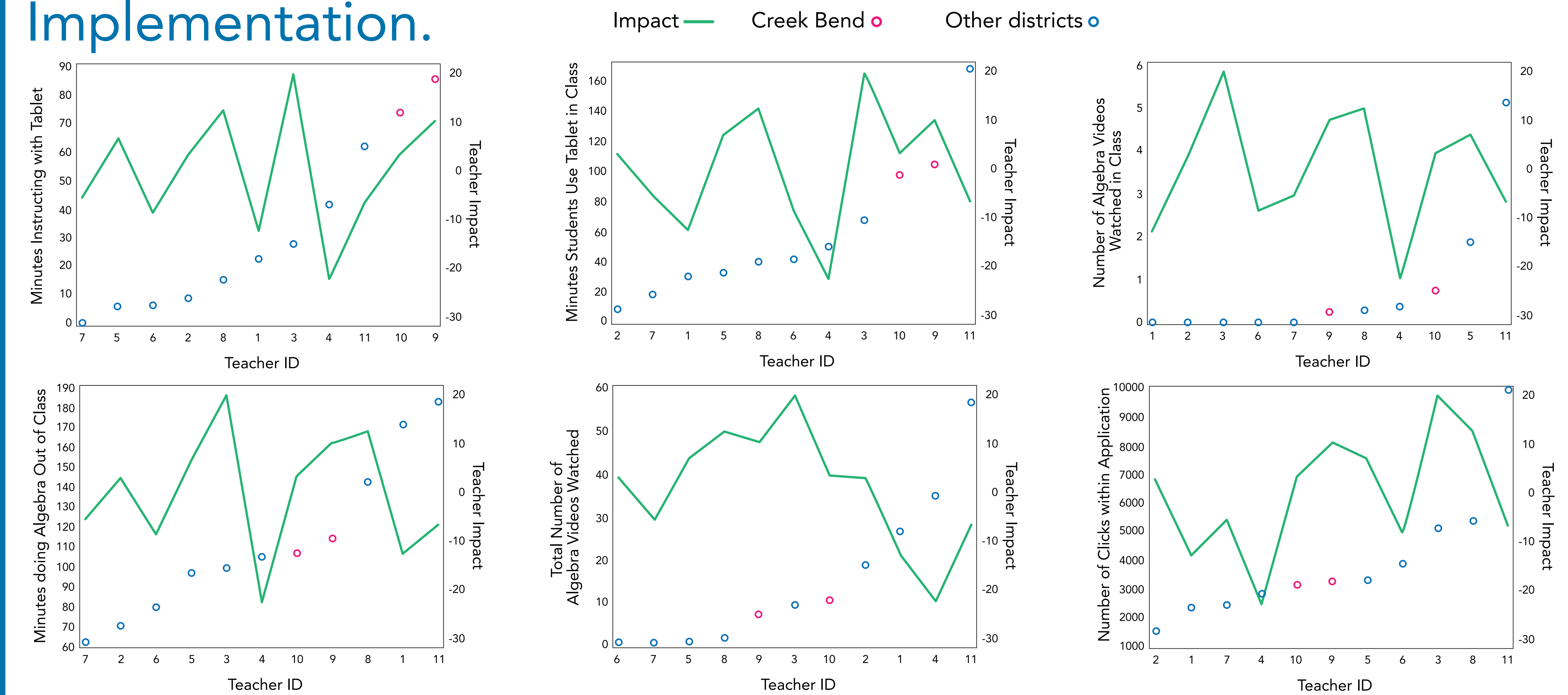
Implementation.

Table 1: Implementation and Impact by Teacher

| Teacher | Implementation | | | | | | Impact |
	Average Minutes Instructing with Tablet per Week[a]	Average Minutes Students Use Tablet in the Class per Week[a]	Average Number of Algebra Videos Watched in Class per Week[a]	Average Minutes Spent on Algebra Out of Class per Chapter[b]	Average Number of Algebra video watched per Year[b]	Average Number of Clicks within App per Year[c]	Teacher Effect
1	22.5	30.0	0	171.5	26.5	2370.2	-12.71
2	8.6	8.6	0	70.1	18.8	1552.0	3.00
3	27.5	67.5	0	99.2	9.5	5139.0	19.82
4	41.7	50.0	.4	104.8	34.8	2854.2	-22.58
5	5.6	32.5	1.9	96.7	.9	3321.9	6.99
6	6.3	41.9	0	79.6	.7	3887.8	-8.50
7	0	18.6	0	61.9	.7	2460.0	-5.45
8	15.0	40.0	.3	142.8	1.7	5380.4	12.55
9	85.6	104.4	.3	114.1	7.2	3281.3	10.11
10	73.8	97.5	.8	106.6	10.4	3163.0	3.39
11	61.9	167.5	5.1	183.2	56.7	9938.6	-6.61

[a] Source: Teacher Survey
[b] Source: Student Survey
[c] Source: Device Log Data

Table 2: Implementation versus Impact

Implementation variable	Regression Coefficient[d]	p value
Average Minutes Instructing with Tablet per Week[a]	-0.09	.38
Average Minutes Students Use Tablet in the Class per Week[a]	-0.06	.37
Average Number of Algebra Videos Watched in Class per Week[a]	-1.33	.49
Average Minutes Spent on Algebra Outside of Class per Chapter[b]	-0.08	.31
Average Number of Algebra Videos Watched per Year[b]	-0.22	.17
Average Number of Clicks within App per Year[c]	-0.00	.88

[a] Source: Teacher Survey
[b] Source: Student Survey
[c] Source: Device Log Data
[d] From a teacher-level regression of estimated block-specific impact on measured implementation.

Conclusion.

We expected implementation in Creek Bend to be high compared to the rest of the sample, and we expected a positive relationship overall between implementation and impact. Creek Bend showed stronger implementation on two measures. However, generally (across teachers) there was no association between any of the measures of implementation and impact. The implementation measures examined in this study do not account for the observed differences in the impact overall. The greater impacts in Creek Bend may be accounted for by other mechanisms. Possibilities include differences in student motivation (which we may explore through the Student Attitude Questionnaire administered at the beginning and end of the school year), differences in more-specific uses of the application (as captured through log data), and differences in the composition of student populations or other contextual features of Creek Bend.