Impact Report:

Visalia Unified School District

Visalia, California (2022-23)

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Executive summary

To study the effects of Paper on students' academic achievement in grades four through eleven, the Paper Impact team conducted a quasi-experimental study in collaboration with Visalia Unified School District (USD) in Visalia, CA. Researchers examined the academic performance of over 13,000 students in the 2022-23 school year, as measured by i-Ready* math and reading scores.

This study revealed that 853 students in grades six, nine, and ten who used Paper Review Center for writing feedback scored on average 5 points higher on their i-Ready scores in reading compared to students who did not. The study also determined 524 students in grades four, six, and eleven who used Paper Live Help for math scored on average 4 points higher on their i-Ready scores in math compared to students who did not.

Lastly, certain subgroups of students who used Live Help for English scored higher compared to other students who used the feature. Specifically, non-white students scored 6 points higher on their i-Ready reading benchmark compared with white students, and female students scored 5 points higher compared with male students. Notably, English Learners (EL) who used Live Help tutoring experienced 7 points higher scores than their non-EL peers.

However, it's important to acknowledge selection bias, group size, teacher quality, and teacher implementation limit the study's understanding of the drivers of student outcomes. In particular, students who used Paper had higher baseline scores on average. Nonetheless, these findings demonstrate a statistically significant positive relationship between usage of Paper and academic outcomes. Researchers recommend the following for a deeper understanding of how Paper contributes to student academic outcomes.

- **Drive equitable outcomes:** Encourage more educators, particularly educators who serve lower-performing students, to use Paper with more students, more frequently. Doing so will not only diminish the limitation of group size, but likely increase i-Ready reading and math scores. Specifically, given promising early trends that suggest that English tutoring may be especially supportive to students of color and English Language Learners, researchers suggest deeper and more intentional implementation of Live Help for English with these students.
- **Build context:** Run a second research study that includes an analysis of educator implementation practices. This will help contextualize the key factors that drive adoption and the relationship of Paper usage and student academic outcomes.
- **More rigor:** Run a randomized control trial (RCT) and/or teacher controlled study across a select group of Visalia USD. Doing so will help pinpoint the relationship between use of Paper and student outcomes by student groups and control for selection bias and/or teacher quality/ implementation.

Introduction

Paper is an Educational Support System (ESS) designed to address students' developing needs throughout their academic journeys. The ESS is a learning platform that supports students on their learning and discovery journeys across grades and subjects. Paper helps students master skills, complete assignments, and make connections among areas of study and future careers. Likewise, Paper supports students as they create and adjust their academic plans for postsecondary success.

Specifically, Paper offers interactive and independent practice opportunities in math (Math Missions) plus reading and vocabulary (Paper Reading); expert writing feedback on a wide variety of content (Review Center); and on-demand tutoring for personalized academic support (Live Help). These features enable students to access academic resources whenever and wherever they need. This study looks specifically at usage of Live Help and Review Center.

This study sought to answer the following research questions:

1. What was the rate of Paper usage (Review Center and Live Help) by Visalia USD students?
    a. How did adoption vary by grade level?
    b. How did adoption vary by race, IEP status, EL status, and gender?
2. How does Paper usage (Review Center and Live Help) affect student academic achievement as measured by i-Ready benchmarks used by the district?

District Partnership

To answer these questions, Paper partnered with Visalia USD, located in Visalia, California. Visalia USD is a district composed of 41 schools that serve just over 29,000 students. To assess the effects of Paper, this analysis focused on the grades that had the highest and most consistent usage of Paper by product—grades four through eleven.

Implementation and Outcomes

Methods

The study used a quasi-experimental design to understand growth toward annual goals as measured through i-Ready benchmark scores, comparing students who used Paper during the 2022-23 school year to students who did not use Paper. A quasi-experimental design measures the impact of an intervention by comparing those who use the intervention to those who do not while controlling for covariates known to influence outcomes (such as gender, race, baseline score, and grade level). Students who used Paper during the school year were part of the intervention group, and students who did not utilize Paper were part of the comparison group.

To analyze the effects of Paper on student growth, researchers ran multiple regression models predicting students i-Ready scale scores by Paper usage (number of activities), controlling for prior achievement, race, gender, IEP status, and EL status. Outliers were removed for precision of analysis. Below, researchers present the findings of 1) usage and 2) the statistically significant predictive models for each respective Paper product and their relevant student outcomes.

Outcome Measurement: i-Ready Benchmarks
To gauge success, the district shared i-Ready benchmark information such as percentiles, diagnostic scores and gain, annual and stretch goals, growth toward goals, and overall placement. These i-Ready benchmarks are targeted digital assessments that ensure educators can assess students' performance and growth in math and reading. The study uses scale score in math and reading as outcome measures and uses the diagnostic scale score as a control for prior achievement.

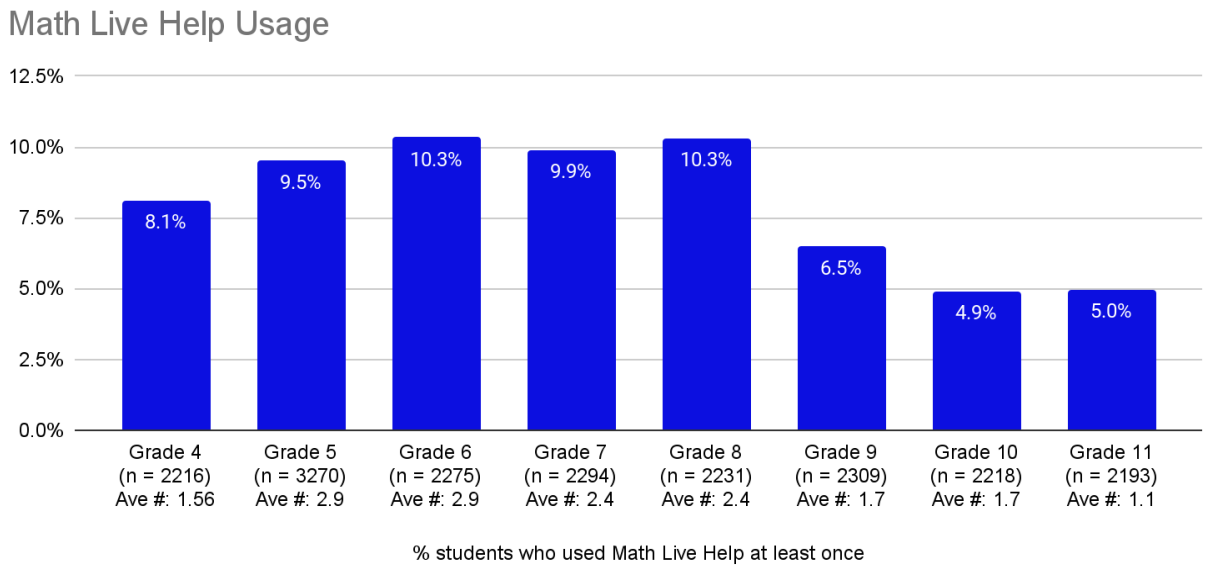
Paper Live Help

Paper Live Help connects students with tutors who support them in studying for tests, completing assignments, exploring new topics, and more. Research highlights the deep benefits of high-impact tutoring for student learning (Loeb & Robinson, 2021; Wood & Wood, 1996; Topping, 2000[2]), and internal qualitative research suggests that accessibility to virtual tutors can address academic resource inequities with students and support educators to meet students' academic needs both in and out of the classroom. Unlimited help is available instantly across many subjects and in multiple languages.

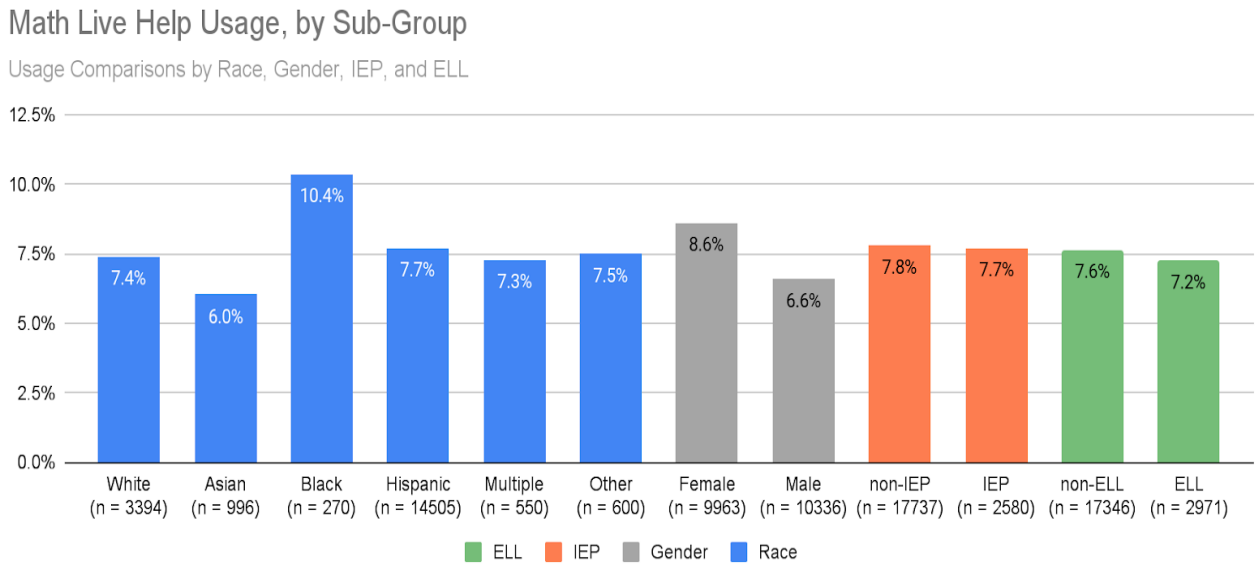
[1] https://www.curriculumassociates.com/programs/i-ready-assessment/standards-mastery
[2] Robinson, C., and Loeb, S.. (2021). High-Impact Tutoring: State of the Research and Priorities for Future Learning. (EdWorkingPaper: 21-384). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/qf76-rj21 ; Wood, D., & Wood, H. (1996). Vygotsky, tutoring and learning. Oxford review of Education, 22(1), 5-16. Chicago; Topping, K. (2000). Tutoring. Educational Practices Series; 5.

Live Help for math

On average, students in grades four through eleven used Live Help for math tutoring 2.3 times. Grades five through eight had the largest adoption, with 10% of students using Paper Live Help for math tutoring an average of 2.5 - 3 tutoring sessions.

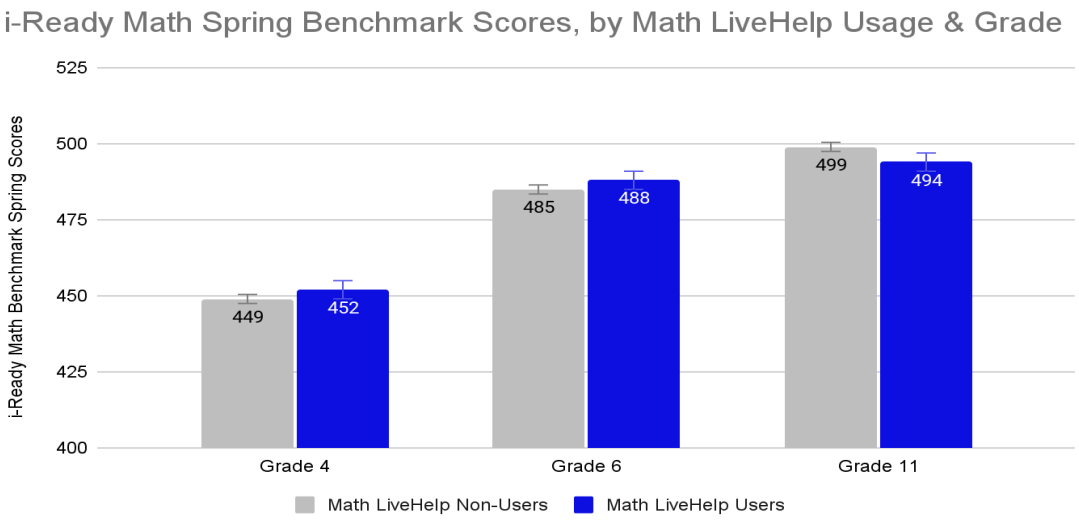


Black students had the highest adoption at 10%, while Asian students saw the lowest adoption at 6%.



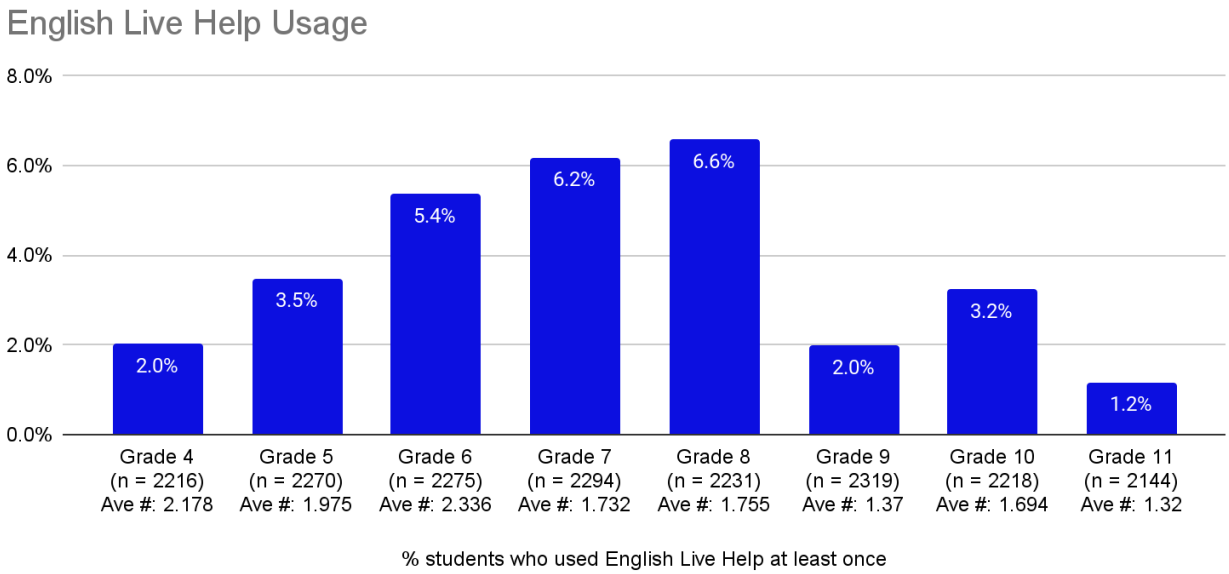
Math Live Help Effects on i-Ready Math Benchmarks

Students who used Paper Live Help for math support in grades four, six, and eleven scored higher on average on their i-Ready benchmarks, compared to students who did not ($p < .05$), after controlling for (making equal) fall scores. In particular, fourth grade students who used Math Live Help scored 4 points higher and sixth grade students scored 3 points higher, compared to their peers who did not use Math Live Help. However, eleventh graders who used Paper scored 5 points lower than students who did not use Paper.

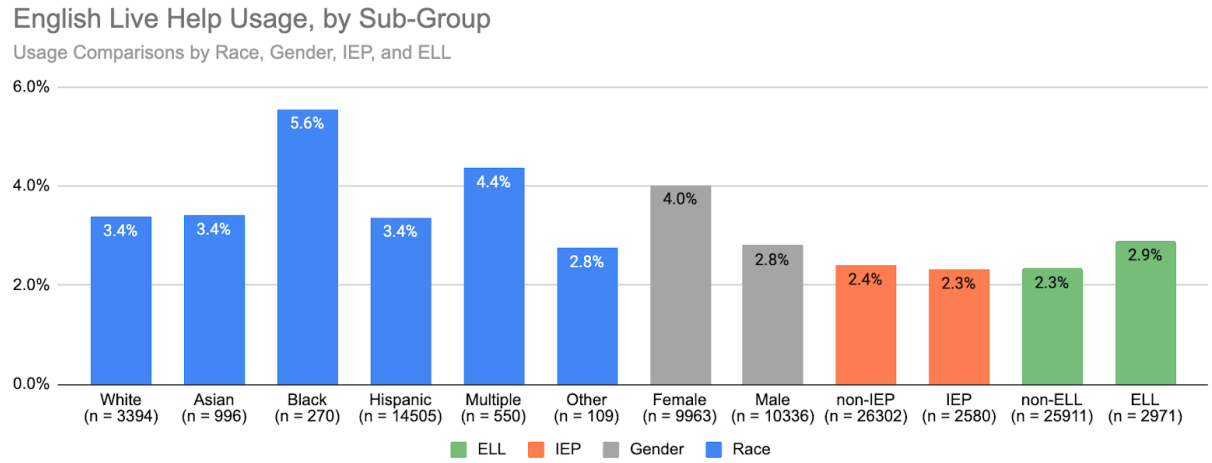


Live Help for English tutoring

On average, students used Live Help for English tutoring 1.8 times. Eighth grade had the largest adoption with 6.6% of students in each grade using Paper Live Help for English tutoring. Eleventh grade had the lowest with 1% adoption.

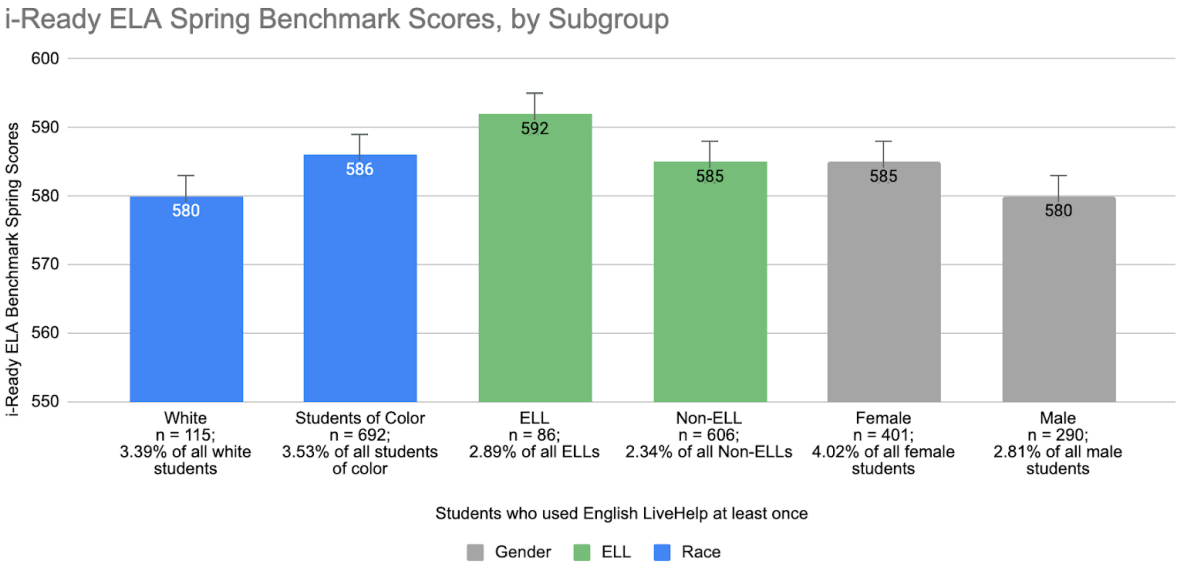


Black students had the highest adoption at 6%, compared to their non-Black peers.



Due to low usage (3.76% across grades four through eleven), there were no statistically significant results for students who used Paper Live Help for English tutoring, compared to students who did not.

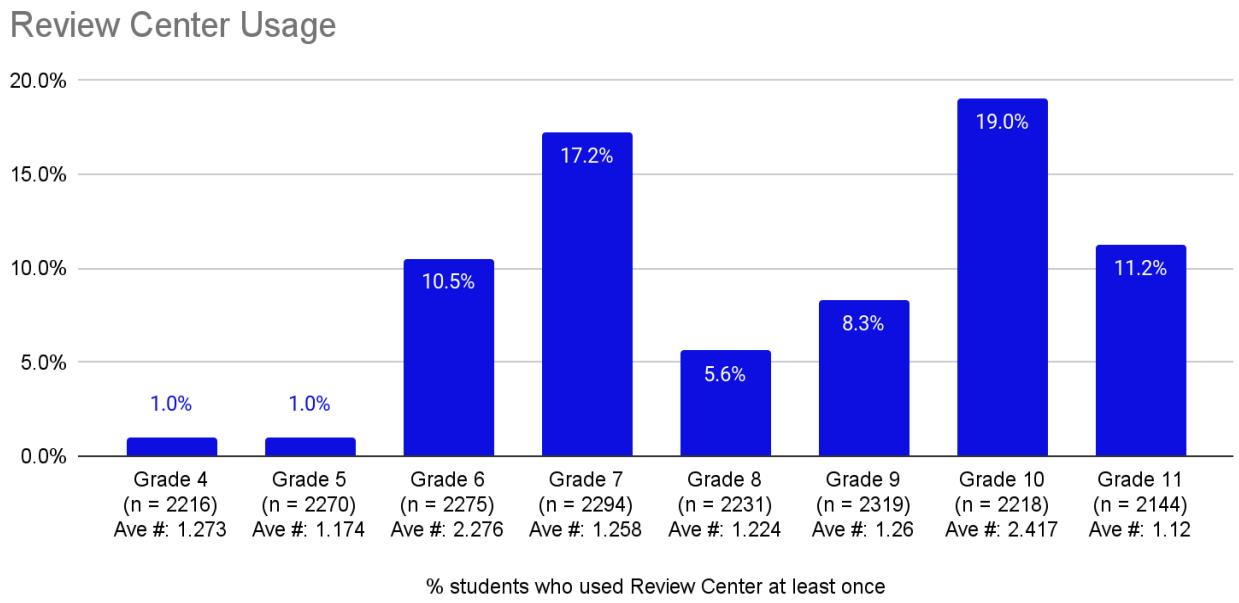
However, there were notable statistically significant results ($p < .05$) for certain subgroups of students with sufficient usage. Students of Color who used Paper Live Help tutoring for English averaged scores 6 points higher than White students who used Paper. Female students averaged a benefit of 5 points higher than male students. Students identified as EL averaged a benefit of over 7 points higher than students not identified as EL. The benefit to EL students in particular is promising, suggesting that Live Help in English is an impactful intervention for English Language Learner students.



Review Center

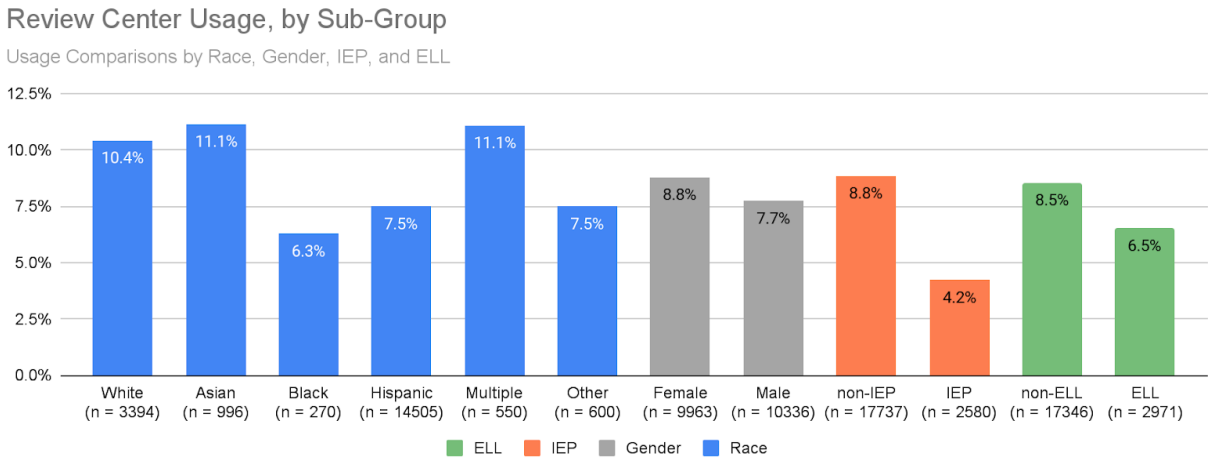
Paper Review Center enables students to upload many kinds of written work for expert feedback—from essays to lab reports and résumés. Research shows that timely, relevant, warm, and constructive formative feedback is crucial to student learning, particularly in learning how to write effectively (Shute, 2008; Irons & Eikington, 2021[3]), and internal qualitative research with educators suggest that leveraging Review Center for early drafts of student work produces benefits for both educators —saving them time and effort—and students—providing them deep, one-on-one tailored writing formative feedback throughout their writing process. Paper tutors review students' drafts asynchronously and provide feedback on style, grammar, plagiarism, adherence to rubrics, and other similar elements.

On average, students used Paper Review Center 1.5 times. Seventh and tenth grade had the largest adoption of Paper Review Center, with 17% and 19% of students using the tool, respectively. Tenth graders also used Review Center at the highest rates, averaging 2.4 submissions; the 10.5% of Sixth graders who used Review Center also used it more frequently, averaging 2.3 submissions. Fourth and fifth grade had the lowest adoption with 1% usage.



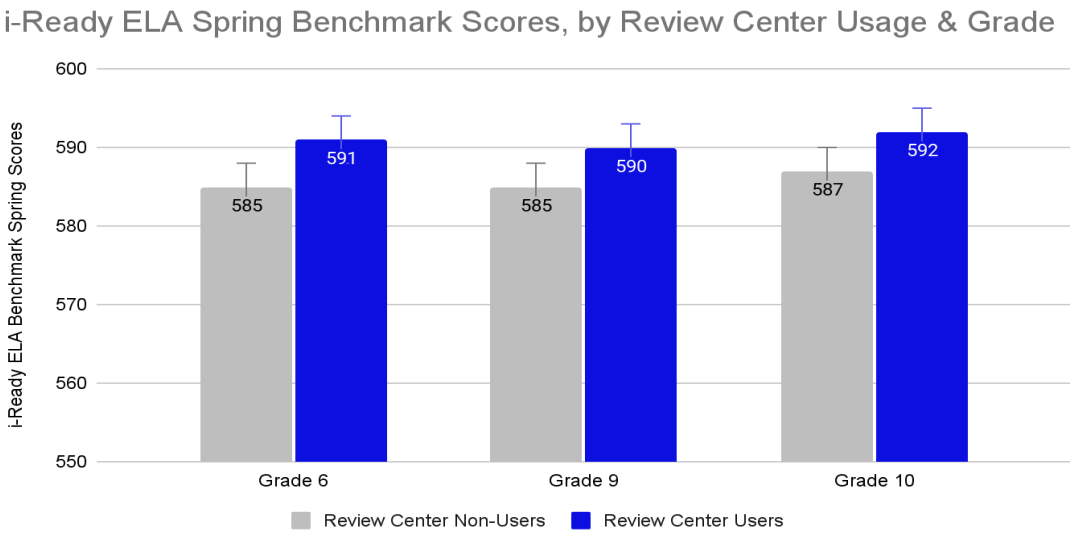
[3] Shute, V. J. (2008). Focus on formative feedback. Review of educational research, 78(1), 153-189; Irons, A., & Elkington, S. (2021). Enhancing learning through formative assessment and feedback. Routledge.

Asian and multiracial students had the highest adoption at 11%, while Black students saw the lowest adoption at 6%, as well as students with IEPs at 4%.



Review Center Effects on i-Ready ELA Benchmarks

Students who used Paper Review Center in grades six, nine, and ten experienced greater gains on their i-Ready ELA benchmarks, compared to students who did not ($p < .05$). In particular, students who used Review Center in sixth grade averaged over 6 points higher, users in ninth grade averaged over 5 points higher and students in tenth grade averaged almost 5 points higher. It's especially noteworthy that students in grades six and ten also had the highest rates of usage, on average submitting more than two pieces of writing for feedback on Review Center; it is possible that more regular use of the tool for supporting feedback and revision of student writing is what drives differentiated student ELA outcomes.



Discussion

Students at Visalia USD who utilized Paper Review Center and Live Help for math and English tutoring saw statistically significant improvement in their scores as measured by i-Ready benchmark assessments. Given that the model accounts for where students started, the data suggests that students of all abilities may have their math and ELA learning accelerated by using Paper. In particular, ELL students who used Live Help tutoring experienced greater growth than their non-ELL peers, suggesting that online tutoring can address and close inequitable gaps in ELA outcomes.

This growth is especially promising given the light to moderate use of Paper. On average, students used Paper Review Center 1.5 times, Live Help for math tutoring 2.3 times, and Live Help for English tutoring 1.8 times during the 2022-23 school year. In turn, more consistent use of the Review Center and Live Help has the potential to accelerate ELA and math growth.

Limitations

There are three main limitations in this quasi-experimental study—unequal group size, variation in teacher implementation, and student self-selection bias.

- **Unequal group sizes:** In some of the activity types (i.e., Review Center for third through sixth graders and Live Help for seventh and eighth graders), the groups of users versus nonusers were unbalanced, which could potentially lead to unequal comparisons and greater margin of error. This also led to a limited ability to analyze by subgroup, leading to no statistically significant results for certain subgroups such as gender or race.
- **Teacher implementation:** Teacher effectiveness is one of the leading indicators of student academic achievement,[4] but this study did not control for the wide variation in teacher implementation of Paper.
- **Self-selection bias:** Researchers found that the selection bias in the difference of the Paper user and non-Paper user groups was statistically significant. Based on baseline i-Ready benchmark scores, students who were Paper users had higher prior achievement than students who were not Paper users. Given this discrepancy, the groups of Paper users and non-Paper users were unequal. It is possible that students who opted to or were encouraged to use Paper's ESS (or edtech more generally, especially in contexts outside of school) have access to better resources or supports generally. On the other hand, students who may have less support, knowledge, or encouragement to use ESS—often students who come from lower-income households, immigrant students, or students of color—may struggle to access or navigate edtech and similar academic resources. Without a larger sample size and contextual variables to examine such factors, it is difficult to determine this self-selection bias.

Without more consistent implementation across classrooms or random assignment of students to groups of users and non-users, researchers are limited in their ability to make explicit, direct causal claims about Paper's impact on student learning outcomes.

[4] James H. Stronge, Thomas J. Ward, and Leslie W. Grant, "What Makes Good Teachers Good? A Cross-Case Analysis of the Connection Between Teacher Effectiveness and Student Achievement," Journal of Teacher Education (September 2011): https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=8b0b456eef40abea0670183ed8d69f89c36362be

Future Study Recommendations

In order to best understand how Paper can improve its impact on students, the researchers on the Paper Impact team recommend the following activities.

1. Drive equitable outcomes: Encourage more educators, particularly educators who serve lower-performing students, to use Paper. Doing so will not only diminish the limitation of group size, but likely increase i-Ready reading and math scores. Specifically, given promising early trends that suggest that English tutoring may be especially supportive to students of color and ELLs, researchers suggest deeper and more intentional implementation of Live Help for English with these students.

The key research question for further study would include:

- What is the adoption of Paper usage per teacher and student subgroup?
- Specifically, does leveraging Paper as an equity intervention close inequitable gaps in ELA outcomes for students of color and ELLs, compared to their peers?

2. Build context: Run a second research study that includes an analysis of educator implementation practices. This will help contextualize the key factors that drive adoption and the relationship of Paper usage and student academic outcomes.

The key research questions for further study would include:

- How are educators implementing Paper into their practice?
- What are the impact of various implementation methods?

3. Greater rigor: Run a randomized control trial (RCT) and/or teacher controlled study across a select group of students at Visalia USD. Doing so will help pinpoint the relationship between use of Paper and student outcomes by student groups and control for selection bias and/or teacher quality/ implementation.

The key research question for further study would include:

- What is the causal relationship between Paper usage and student academic achievement by student subgroups?
- Specifically, does Paper accelerate gains in math and ELA outcomes for students of color and ELs at Visalia, compared to similar students who do not use Paper?

Conclusions and recommendations

Paper demonstrated a statistically significant positive effect for students who used the Review Center for writing feedback, Live Help for math tutoring, and Live Help for English tutoring. With improvements for most Paper activities on i-Ready benchmarks ranging from 2-6 points among Paper users. Even with limited usage, there is strong evidence that Paper is beneficial to growing students' academic performance and outcomes, and with deep implementation and usage has the potential to close inequitable gaps in student achievement. To build on this foundational understanding of the impact of Paper on students at Visalia USD, researchers recommend more consistent implementation of Paper for a larger, more representative group of students and more rigorous studies.

Thank you and recognition

This study was possible due to the exceptional work of Visalia USD under the leadership of Superintendent Kirk Shrum. Special thanks is given to Administrator of Instructional Technology, Rick Hamilton. A deep gratitude is given to the community of Visalia USD for all it does on behalf of students. And of course, to the students of Visalia USD, thank you for your hard work, energy, and brilliance.

Appendix

Implementation by product type

Review Center usage details

Grade	Non-Paper user	Paper user	Range	Average
4	2,194	22 (1%)	1-5	1.273
5	2,247	23 (1%)	1-3	1.174
6	2,036	239 (10.5%)	1-8	2.276
7	1,899	395 (17%)	1-8	1.258
8	2,106	125 (5.6%)	1-5	1.224
9	2,127	192 (8%)	1-14	1.26
10	1,796	422 (19%)	1-11	2.417
11	1,903	241 (11%)	1-7	1.12

Student subgroup	Non-Paper user	Paper user	Percent
Asian	885	111	11%
Black	253	17	6%
Hispanic	13,416	1,089	7.5%
White	3,040	354	10%
American Indian[5]	77	5	6%
Two or more races	489	61	11%
No Answer[6]	453	38	7.7%
Pacific Islander	25	2	7%
Male	9,087	799	9%
Female	9,537	876	8%
non-ELL	15,863	1,483	8.5%
ELL	2,777	194	6.5%
non-IEP	16,169	1,568	9%
IEP	2,471	109	4%

[5] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.

[6] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.

Live Help (math tutoring) usage details

Grade	Non-Paper user	Paper user	Range	Average
4	2,036	180 (8%)	1-27	3
5	2,959	311 (9.5%)	1-35	3
6	2,040	235 (10%)	1-21	3
7	2,067	227 (10%)	1-20	3
8	2,001	230 (10%)	1-27	2.52
9	2,159	150 (6.5%)	1-10	2
10	2,109	109 (5%)	1-214	3[7]
11	2,084	109 (5%)	1-7	2

Student subgroup	Non-Paper user	Paper user	Percent
Asian	936	60	6%
Black	242	28	10%
Hispanic	13,388	1,117	8%
White	3,143	251	7%
American Indian[8]	77	5	6%
Two or more races	510	40	7%
Pacific Islander[9]	25	2	7%
Male	9,655	681	7%
Female	9,104	859	9%
non-ELL	16,020	1,326	8%
ELL	2,756	215	7%
non-IEP	16,353	1,384	9%
IEP	2,423	157	4%

[7] Excluded student with 214 for average activities to avoid skewing data.

[8] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.

[9] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.

Live Help (English tutoring) usage details

Grade	Non-Paper user	Paper user	Range	Average
4	2,171	45 (2%)	1-8	2.178
5	2,191	79 (3.5%)	1-9	1.975
6	2,153	122 (5%)	1-18	2.336
7	2,152	142 (6%)	1-23	1.732
8	2,084	147 (6.6%)	1-17	1.755
9	2,273	46 (2%)	1-5	1.37
10	2,146	72 (3%)	1-9	1.694
11	2,119	25 (1%)	1-4	1.32

Student subgroup	Non-Paper user	Paper user	Percent
Asian	962	34	3%
Black	255	15	6%
Hispanic	14,016	489	3%
White	3,279	115	3%
Multiple	526	24	4%
American Indian[10]	79	3	4%
Pacific Islander[11]	27	0	0%
Female	9,562	401	4%
Male	10,046	290	3%
non-ELL	25,305	606	2%
ELL	2,885	86	3%
non-IEP	25,670	632	2%
IEP	2,520	60	2%

[10] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.

[11] Combined American Indian and Pacific Islander in Race category "Other" due to low numbers.