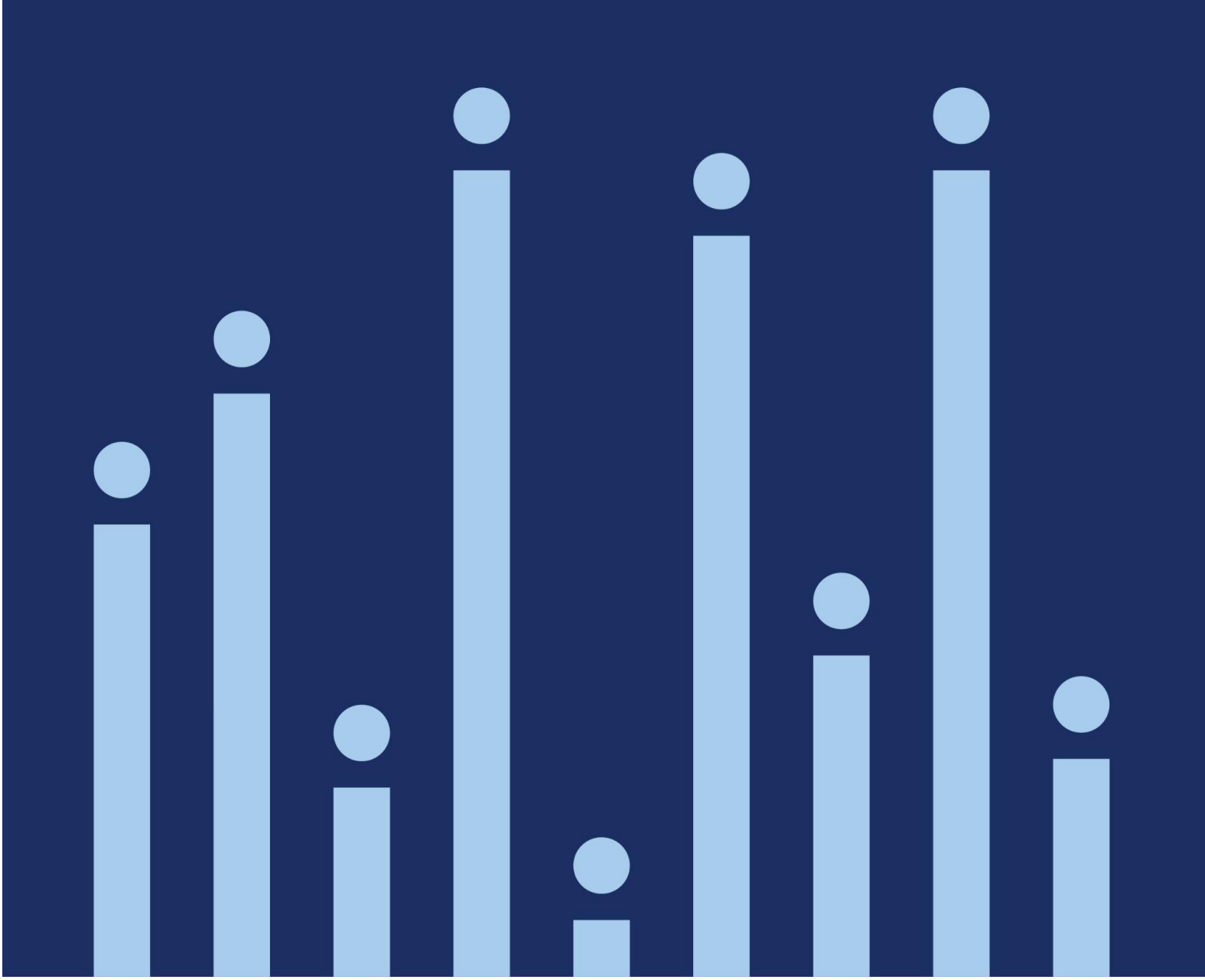

FasterReading Impact Evaluation

Endline report on over-age ECE student learning outcomes following an accelerated learning program

IDinsight

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Endline report on over-age ECE student learning outcomes following an accelerated learning program

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Acronyms, List of Figures and Tables

Acronyms

COVID	Coronavirus Disease
CVC	Consonant-Vowel-Consonant
ECE	Early Childhood Education
FR	FasterReading
HFC	High-Frequency Check
IPW	Inverse-Probability Weight
ITT	Intention-to-Treat
LEAP	Liberian Education Advancement Program
PAP	Pre-Analysis Plan
PE	Process Evaluation
RAN	Rising Academy Network
RCT	Randomised Controlled Trial
SD	Standard Deviation
SL	School Leader
SPM	School Performance Manager
ToT	Treatment-on-the-Treated

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Executive Summary

RAN is developing an accelerated reading program, FasterReading (FR), to support primary grade students on foundational reading. During the 2021-22 school year, RAN implemented the FR program in ECE, Grade 3, 4, 5, and 6 primary classes in their schools in Liberia for the first time since the first part of program development was completed. This study focuses on the ECE sections of these schools, and specifically over-age children in those classes, who are at particular risk of dropout.

RAN partnered with IDinsight to generate early-stage insights for program iteration and improvement, and to assess the impact of the FR program for over-age ECE students on learning outcomes and school attendance. We conducted a randomised controlled trial (RCT) in 74 of 95 RAN-supported schools across 10 Liberian counties. RAN rolled out FR in 37 treatment schools from January to July 2022 while 37 other schools received regular ECE programming.

Key findings:

- **The FR program likely led to modest positive effects on reading proficiency,** though the precise impact is unclear due to incomplete implementation in half of the treatment schools and partial implementation in a quarter of control schools. We estimate that an over-age ECE student exposed to the full FR program would gain 0.12 more FR reading levels than a student who received none of the FR program ($p = 0.10$). Given low growth in reading proficiency in the control group, this modest effect represents a relatively more impressive 0.28 SD or 36% improvement over the status quo.
- **The FR program did not have any adverse effect on students' math proficiency**. The program also did not have significant effects on students' enjoyment of school or reading.
- **The FR program had a positive impact on school attendance.** Students exposed to the full FR program were 11.4 percentage points more likely to be present for attendance checks by SPMs than students in the control group.
- **FR students were less likely to practise reading at home.** Students exposed to the full FR program were 12.1 percentage points less likely to report practising reading at home compared to students who received none of the program ($p = 0.05$).

Recommendations:

The results of this RCT may have been influenced by implementation challenges. Reports from RAN staff and teachers and findings from RAN's process evaluation in 2021 indicate that the FR program faced several implementation challenges, including teachers' unfamiliarity with the new curriculum and need for further training, and insufficient student materials and workbooks. Addressing these challenges may increase the impact of the program. We also encourage RAN to explore opportunities to support students with reading practice at home, and possibly to further tailor instruction to smaller, more homogenous reading groups.

Moreover, some teachers and school leaders were confused about the treatment/control status of schools, since all staff were trained in FR implementation, and the treatment assignment only applied to ECE classrooms. This confusion led to significant exposure of ECE students to the program or to program materials in certain control schools, and incomplete implementation in certain treatment schools. As a result of treatment non-compliance, impact estimates are somewhat less precise than we anticipated in the design.

Despite these challenges in implementation and measurement, FR appears to have a modest impact on reading proficiency. This being the first pilot, the program is in its very nascent stages and RAN plans to iteratively improve on it to attain greater impact. While current impact estimates are imprecise, early results of the FR program suggest that, once implementation challenges have been addressed, the program may be a cost-effective approach to improving reading outcomes.

1. Introduction

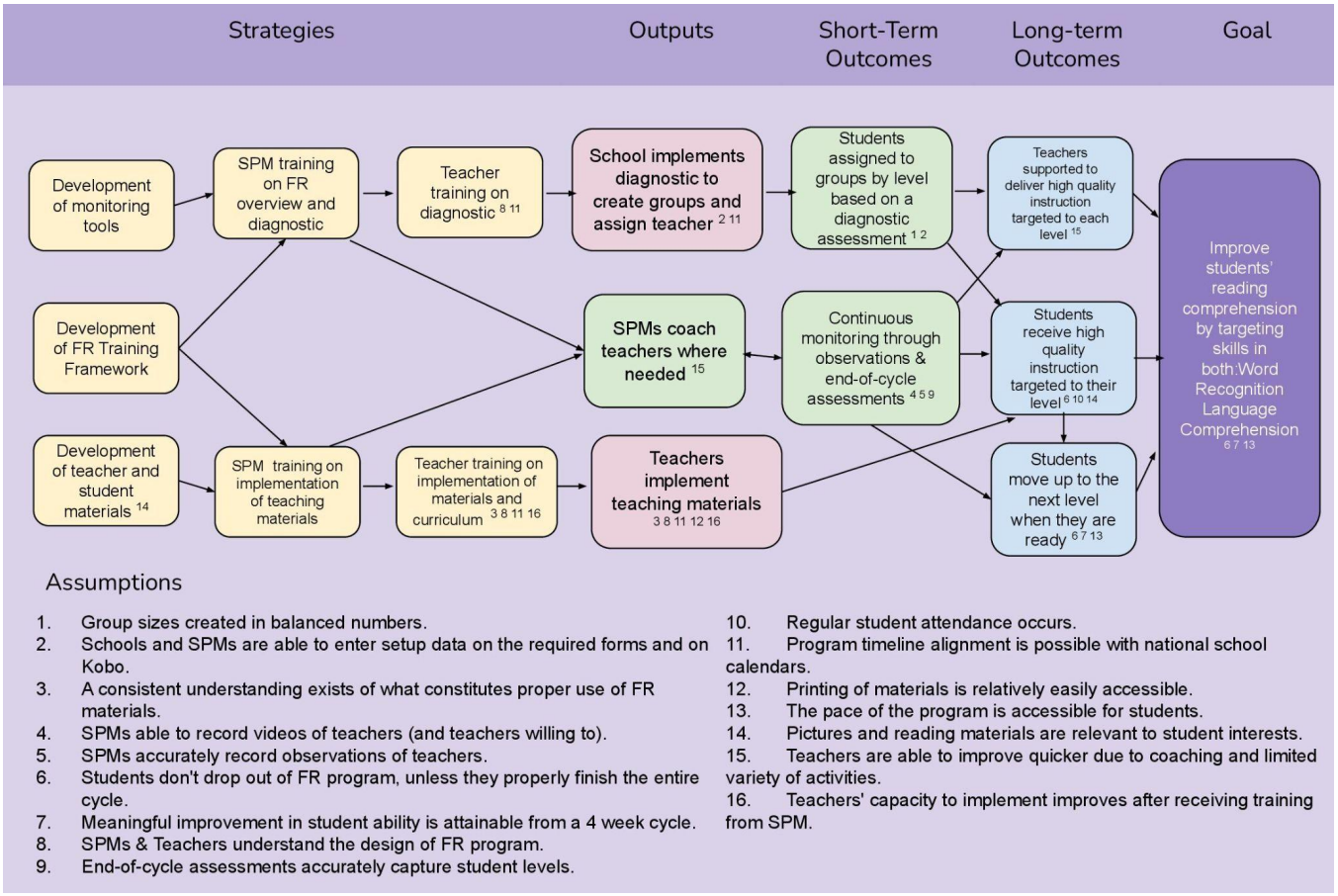
RAN is developing an accelerated, phonics-based reading program, FasterReading (FR), to support ECE and primary grade students in foundational reading.

The FasterReading curriculum consists of an accelerated reading program that runs alongside regular school programming. The 2021-22 school year is the first year that RAN is iterating and testing the FR program. In this first year, RAN has developed 3 out of 5 FR modules: “Letter level”, for students learning letter names and sounds; “CVC level”, for students learning simple consonant-vowel-consonant words; and “Word level”, for students learning to read words with blends and short vowel sounds. FR teachers assess students at regular intervals during the school year, sort students into groups with other students at the same level of reading proficiency, and target instruction to each group’s learning needs.

During the 2021-22 school year, RAN trained all teachers in its 95 LEAP schools in the new FR curriculum. Subsequently, schools were instructed to implement the program in all Grade 3, 4, 5, and 6 classes. For the purposes of this study, half of eligible schools were randomised to additionally implement the FR program in ECE classes, while the other half were randomised to a control group where teachers would continue teaching the standard reading curriculum. This design, which was necessitated by the desire to not withhold the program to students in Grades 3 through 6, resulted in some confusion about the treatment status of schools for ECE, leading to non-compliance in some schools. We describe this issue and how we adjusted treatment estimates below.

A detailed theory of change developed by RAN for the program is depicted in **Figure 1**.

Figure 1: FR Theory of Change



We partnered with RAN to assess the impact of the FasterReading program in ECE classrooms and to generate early-stage insights for iteration and improvement. We specifically focus on over-age ECE students since these students are at particular risk of not progressing through reading levels and of early drop-out. The evaluation was conducted across RAN-supported schools that had ECE grades and at least three teachers in the whole school. Out of 95 schools supported by RAN in Liberia, RAN identified 75 that were eligible for the FR program. One school was dropped prior to baseline since it was no longer supported by RAN, leaving 74 schools in the study.

Program implementation began in June 2021 following the initial baseline in May 2021. Due to COVID-related school closures in Liberia, the FR program and evaluation were restarted with a new cohort of over-age ECE students from late November - early December 2021. As a result of this timeline, FR ran for only 6 months of the 2021-22 school year, rather than the full 10 months as stipulated in the program design. **Table 1** shows the overall FR implementation and evaluation timeline of activities

Table 1: Overall FR implementation and impact evaluation timeline.

Period	Activities
May 2021	• Teacher training on FR • FR material preparation • Initial FR baseline assessments • Randomization
June 2021	• FR implementation starts
July 2021	• Early and unexpected COVID-induced school closures[1] • FR implementation halts after three weeks
November 2021	• Schools reopen • FR baseline assessments with a new cohort of ECE students • Balance checks on randomization
December 2021	• Teacher retraining on FR
January 2022	• FR implementation restarted
July 2022	• FR implementation ends • Endline assessments

This endline report describes the impact of FR on learning outcomes of over-age ECE students in RAN schools in Liberia. The results of this research will be used by RAN to inform scale-up decisions and will be shared with government partners to inform ECE programming across the region.

[1] https://web.facebook.com/LiberiaMOE/posts/3002570980013874

2. Study Design

To estimate the impact of the FR program, we conducted a randomised controlled trial (RCT) in 74 of 95 RAN-supported schools across 10 Liberian counties, namely, Bomi, Gbarpolu, Grand Bassa, Grand Cape Mount, Margibi, Maryland, Montserrado, River Gee, Rivercess and Sinoe. The estimated program impact was measured through a comparison of the treatment group, which consists of schools where the FR program was provided to over-age ECE students, relative to the control group, which consists of schools where the FR program was not provided to over-age ECE students. The process of randomization and selection are outlined in section 2.2.

2.1 Research questions

This evaluation estimates the effects of treatment on over-age ECE student learning outcomes. Our primary and secondary research questions were as described below.

Primary question

- What is the impact of an accelerated reading program on over-age ECE students' reading proficiency?

Secondary questions

- What is the impact of the FR program on math proficiency?
- What is the impact of the FR program on student perceptions of schooling and behaviour, including school attendance and reading at home?
- How do treatment effects vary by student gender, baseline performance level, and the year that RAN started supporting a school?

2.2 Sampling and Randomization

The population of interest for this evaluation was all over-age ECE students in RAN-supported schools under the Liberian Education Advancement Program

(LEAP). Out of 95 schools supported by RAN in Liberia, RAN identified 75 that were eligible for the FR program. For this RCT, to meet evaluation requirements, eligible study schools had to have both an ECE section and more than 3 teachers in the whole school.

Following the first baseline in May 2021, we randomly assigned eligible schools to administer either the FasterReading (FR) curriculum (38 schools) or the standard curriculum (37 schools) to ECE classrooms. Randomization was stratified on three characteristics: (i) school-average baseline reading level of over-age ECE students; (ii) over-age ECE student-teacher ratio; and (iii) year that RAN took over the school.

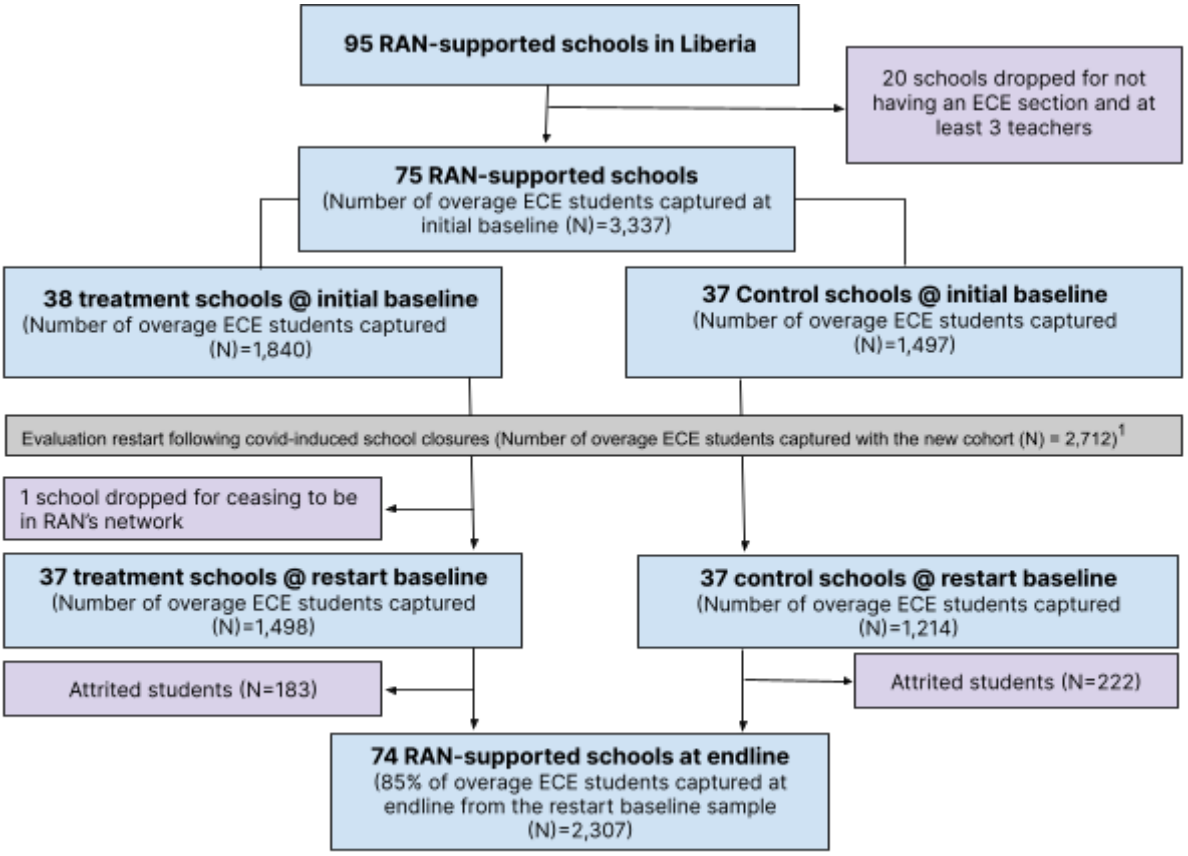
RAN started implementing the FR program in ECE classrooms in treatment schools in June 2021. However, after three weeks of FR implementation, ECE classes were abruptly closed by the Ministry of Education due to fears about rising COVID-19 cases, and the FR program was suspended.

Schools reopened in November 2021, and a new cohort of over-age ECE students was assessed in late November - early December 2021. For this 'restart baseline', enumerators assessed 2,712 over-age ECE students in basic literacy skills across 74 study schools. One treatment school in Sinoe County was dropped since it was no longer supported by RAN, leaving 37 treatment and 37 control schools in the study. After confirming that baseline characteristics were still balanced across treatment and control schools (see Appendix **Table A1**), we retained the original random assignment rather than re-randomize schools. This reduced confusion among schools about their treatment status, though as described below, did not eliminate confusion about which students to include in the FR program.

According to our pre-analysis plan (PAP), we planned on randomly sampling approximately 1,370 students for endline assessments. With 74 schools and approximately 1,370 students in our sample, our study was powered to detect moderate effect sizes of approximately 0.23 standard deviations (SD). However, during endline piloting, RAN staff found that it was easier to instruct enumerators to follow up with all students who were assessed at baseline, rather than to sample a subset of those. Thus our endline sample was larger than anticipated though, as noted below, suffered from some attrition.

A detailed sampling flowchart is depicted in **Figure 2**.

Figure 2: Sampling flowchart



[1] A new cohort was used at restart baseline since most ECE students had moved on to grade one. However, RAN schools got lower enrollment resulting in the reduction in sample size by 19% from 3,337 to 2,712 over-age ECE students.

2.3 Endline data collection

The endline survey tool is included in Appendix D. The reading assessment tool mirrors the assessments used by teachers in the treatment group for assigning students to FR groups, but with different letters, words, and reading passages. RAN designed the endline reading assessment tool and we provided feedback before coding it onto an IDinsight-managed KoboCollect account.

We included additional questions at endline on numerical skills to assess whether the FR curriculum was complementing or crowding out maths instruction. We also included questions on students' perceptions of schooling and reading. Our hypothesis was that the new reading curriculum could alter students' enjoyment of school in general or of reading in particular, which could lead to longer-term learning impacts separately from any direct effects of the FR program on reading ability. These additional questions were piloted among grade 1 and 2 students in RAN-supported schools. Student information and other demographic characteristics such as student's name, grade, age, gender,

and father/guardian's name were preloaded from the baseline data, though with slots for correction. Reading learning assessment results, numerical skills, and student emotional and social wellbeing responses were recorded directly into the KoBoCollect form.[2]

22 enumerators were trained by RAN and IDinsight staff in the objectives of the study, how to administer the survey instrument and assessments, how to collect data using KoboCollect, and how to safely and responsibly collect data during the COVID-19 pandemic. Assessments were conducted over 12 days in July 2022 on school grounds. Students who were not present at school but could be found in the community were assessed by enumerators at their homes. Due to the government's one-week early school closures, our data collection started a week earlier than planned. Enumerators first visited schools that had fully implemented the FR program while we waited for other schools to conclude implementation that week. This was to ensure that students were mostly still in school during the assessment period. Enumerators used their Android devices to collect data on KoboCollect and uploaded it directly to us using an IDinsight-managed server.

During data collection, RAN and IDinsight staff conducted spot checks of field teams. We also ran high-frequency checks (HFCs) and conducted daily debriefs with the RAN data team to address any issues in data quality.

2.3.1. Attrition

Though enumerators attempted to follow up with all students who were assessed at baseline, including tracking students who were absent from school but still in the community, some students could not be assessed at endline. Most of those students who could not be assessed at endline had migrated out of the community and could not be located.

From our total baseline sample of 2,712 students, RAN enumerators assessed 85% (2,307 students). Attrition was slightly higher in the control group (18%) than in the treatment group (12%) ($p = 0.06$). However, as shown in the balance check **Table A1** in Appendix B, the endline sample remains well-balanced on baseline characteristics across treatment and control schools. We, therefore, report estimates for the endline sample without adjusting for attrition in the Results section. As robustness checks, we present results for the main outcomes with inverse-probability weights (IPWs), and Lee Bounds on treatment effects in Appendix B; these do not meaningfully change any of our findings.

[2]Enumerators also had a physical data collection sheet on which responses were recorded during the assessment. The purpose of this was for data verification and in case they could not enter responses directly onto KoboCollect for some reason.

2.3.2. Attendance data collection

Over the course of the program, School Performance Managers (SPM) and School Leaders (SL) collected attendance data, but there was no consistency in how many attendance checks were conducted per school. SPMs conducted up to five attendance checks per school, and School Leaders conducted up to an additional five checks. The median student in our dataset has 4 attendance data points; 21% of students have no data points, and 3% of students have 10 attendance data points. In our analysis, we present results that average across all attendance checks for each student (dropping students who have no attendance data points). We also present results that only average across attendance data points collected by SPMs, due to RAN's concerns about attendance data reported by School Leaders.

2.4 Analytical approach

Stata 17 was used to clean and analyse data before drawing conclusions. The cleaning process involved the removal of duplicate student entries, removal of unconsented assessments, and digitization of student attendance data before merging it with baseline data.

We registered our study design and pre-analysis plan on the American Economic Association registry for RCTs ahead of endline data collection.[3] Our pre-specified model is an 'intention-to-treat' (ITT) estimator, in which we compare students assigned to treatment schools to students assigned to control schools. The regression model is in Appendix C.

We also compare treatment effects for boys vs girls, and for students starting at a lower vs higher level of reading proficiency. The lower level of proficiency consists of students who were unable to recognize letters ("Letter level"). The higher level consists of students who were able to recognize letters but unable to read simple consonant-vowel-consonant words ("CVC level"). Four students at baseline were able to read CVC words but unable to read words with blends ("Word level"); these students were placed in CVC reading groups and are included in the higher-proficiency group in our analysis below.

2.4.1 Non-compliance

Over the course of program implementation, it was discovered that schools

[3]RCT ID: AEARCTR-0007954, https://www.socialscienceregistry.org/trials/7954

deviated from their treatment assignment. Some treatment schools did not implement FR in ECE classrooms or only implemented a subset of the five 4-week FR cycles. Some control schools implemented some FR cycles in ECE classrooms. **Table 2** summarises non-compliance across treatment and control groups.

Table 2: Non-compliance

# FR cycles implemented	Assigned to treatment		Assigned to control	
	# schools	% student sample in T	# schools	% student sample in C
0	1	10%	29	73%
1	3	5%	0	0%
2	1	5%	1	10%
3	5	8%	4	8%
4	9	26%	1	4%
5	18	45%	2	5%

Our preferred approach to address non-compliance is to measure treatment as treatment intensity. We define treatment intensity as the percent of the program that was received by a school. For instance, if a school implemented 3 FR cycles, then we code it as receiving 60% of the program. We then conduct an instrumental variables regression, where treatment intensity is instrumented with treatment assignment.[4]

Our treatment intensity estimator relies on two assumptions: (i) We assume that treatment effects scale linearly with the number of weeks of implementation; (ii) the number of weeks of implementation in control schools is uncorrelated with the size of the potential treatment effect (i.e. that there is no selection bias). For this evaluation, we believe these to be reasonable assumptions. Students likely benefited from more weeks of instruction in the FR program. Qualitative evidence also suggests that most control schools implemented cycles of the FR program in ECE classrooms because of confusion surrounding treatment and control group treatment assignment (namely, that both treatment and control schools were instructed to implement FR in non-ECE classrooms, but that only treatment schools were instructed to implement FR in ECE classrooms).

In addition to our treatment intensity estimator, we report treatment-on-the -treated (ToT) effects in the appendix. Since some schools implemented only part of the FR program, it is unclear whether to treat those schools as 'treated'

[4] This approach follows Gerber & Green, Chapter 5.10 - Estimating Treatment Effects When Some Subjects Receive "Partial Treatment"

or ‘not treated’. To address this we estimated bounds on the ToT effects. The upper bound considers a student treated if they received all 5 cycles of the FR program, otherwise, they are not treated. The lower bound considers a student treated if they received any cycle of the FR program.

The ToT bounds rely on fewer assumptions than the treatment intensity estimator, but they provide much less precise estimates of impact. For this reason, and since we think that the assumptions underlying the treatment intensity estimator are reasonable, we consider the ToT bounds a robustness check and report them in the appendix.

In summary, we report ITT estimates, which align with our pre-specified approach, alongside treatment intensity estimates, which rely on stronger assumptions but we believe are most indicative of the effectiveness of the full five-cycle FR program. Additional treatment-on-the-treated analyses, as well as adjustments that account for attrition, are presented in the appendix as robustness checks.

3. Evaluation Results

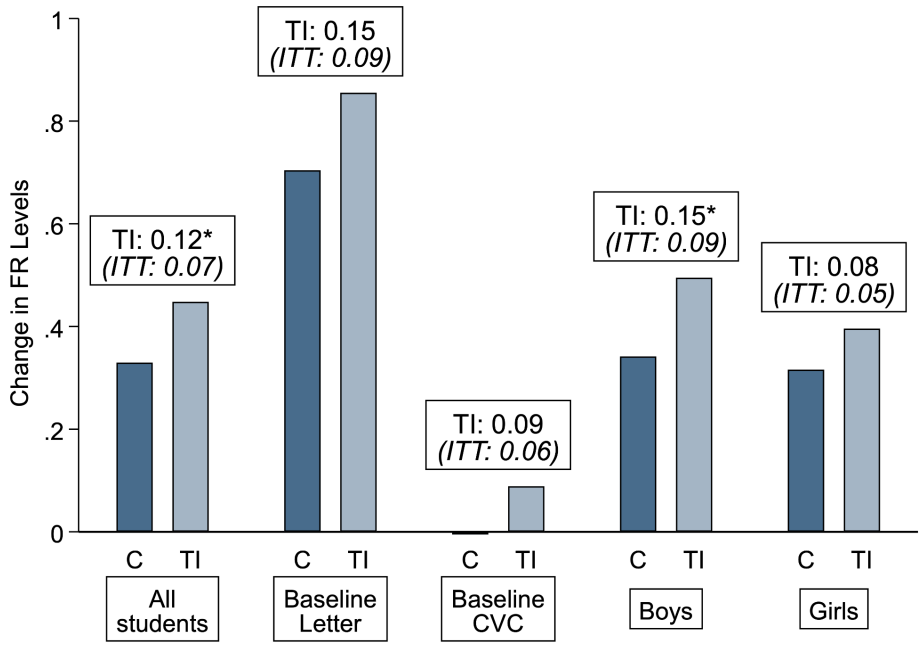
Overall, FasterReading likely led to positive modest effects on reading proficiency and school attendance. FR may also have led students to spend less time practising reading at home.

3.1 Reading

The FR program likely led to a modest effect on reading proficiency. On average, students assigned to treatment schools gained 0.07 more reading levels than students assigned to control schools, though the estimate is not statistically significant ($p = 0.14$). Taking into account non-compliance in treatment and control schools, we estimate that a student exposed to the full FR program would gain 0.12 more reading levels than a student who receives none of the FR program ($p = 0.10$). Since the average student in the control group gained only 0.33 reading levels, this modest effect represents a 36% improvement over the status quo.

Figure 3 shows the effect of the FR program on the change in reading levels between baseline and endline for all students and for priority subgroups. We show differences between students who receive none of the FR program versus all of the FR program (our "Treatment Intensity" or TI estimate); ITT estimates are included in parentheses. Any estimates that are statistically significant are denoted with asterisks.

Figure 3: Effect of FR on reading levels



* p < 0.10, ** p < 0.05, *** p < 0.01

We report descriptive statistics for reading outcomes in **Table A2**, and effect sizes for other reading outcomes in Appendix **Table A6**. Whereas 36% of students in the control group improved at least one FR level, we estimate that if students were exposed to the full FR program, about 44% of students would improve at least one FR level (p = 0.16).

In Appendix **Table A4** we report effect sizes in standard deviations. We estimate that a student exposed to the full FR program would gain 0.28 SD in reading proficiency relative to a student who receives none of the FR program. While this is a moderate standardised effect size compared to the impacts of other programs on test scores, which range from 0.07 and 0.7 SD[5], it is driven not only by the impact of the FR program, but also by the low reading gains of the control group (against which the treatment effect is standardised).

There are no conclusive patterns in treatment effects across subgroups. Students starting at Letter level gain slightly more than students starting at CVC level, while boys gain a bit more than girls, though the differences in effect sizes across subgroups are not statistically significant. We also do not see any clear correlations between how long RAN has worked in a school and the effectiveness of the program. Schools that joined RAN's network in the 2019-20 school year (RAN's fourth year in Liberia) experienced the largest treatment effects whereas schools that joined before and after experienced smaller and insignificant effects.[6]

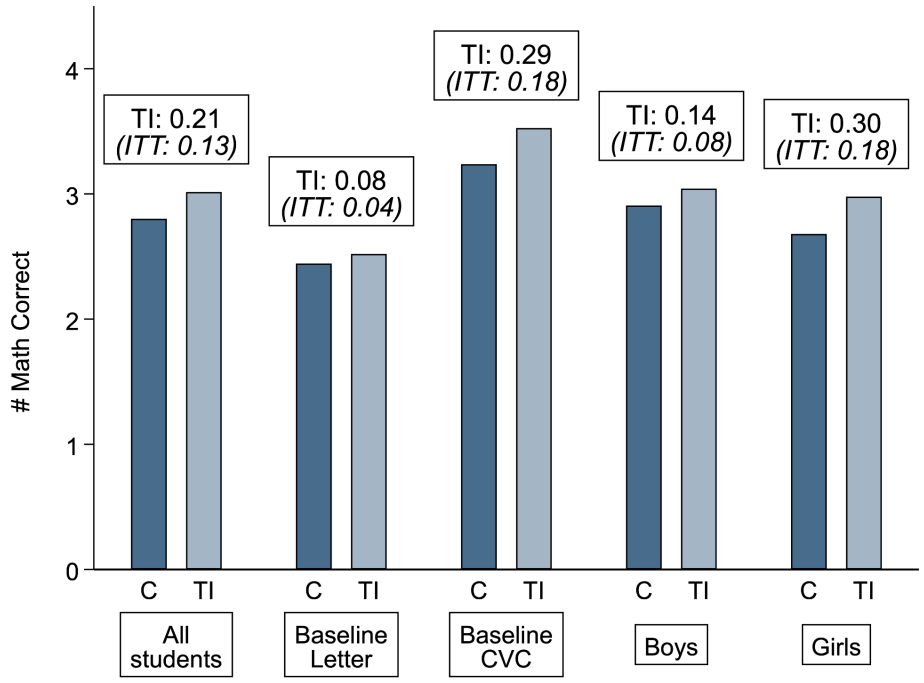
[5] J-PAL. (2019). Tailoring instruction to students' learning levels to increase learning. https://doi.org/10.31485/pi.2522.2019
[6] See Table A3 in the appendix

In addition to growth across reading levels, the FR program may have led to modest improvements in reading proficiency within levels. On average, we estimate that a student exposed to the full FR program would correctly recognize 0.49 more letters than a student who receives none of the FR program, though the estimate is not statistically significant (p = 0.19). Similarly, we estimate that a student exposed to the full FR program would correctly pronounce 0.16 more beginning sounds than a student who receives none of the FR program, though the estimate is not statistically significant (p = 0.33).[7] We report this in **Table A6** in the appendix.

3.2 Math

The FR program does not have any statistically significant impacts on basic math proficiency. **Figure 4** depicts the effect of FR on the average number of math problems answered correctly (out of four). Differences between treatment and control students are small and insignificant.

Figure 4: Effect of FR on average number of math problems answered correctly (out of 4)



[7] We exclude CVC level analysis due to the nonuniform entry of CVC mistakes by enumerators

3.3 Attendance

Students assigned to treatment schools were 6.1 percentage points more likely to be present for SPM or SL attendance checks than students assigned to control schools, though the difference is not precisely estimated (p = 0.09). Students exposed to the full FR program attended 8.1 percentage points more lessons than students who received none of the FR program (p = 0.07).

During program implementation, RAN expressed some concerns about the reliability of the SL data. We reran the analysis only using data collected by SPMs. Using SPM-collected attendance data only, students assigned to treatment schools on average attended 8.3 percentage points more lessons than students assigned to control schools (p = 0.04). We also estimate that a student exposed to the full FR program would attend 11.4 percentage points more lessons than a student who receives none of the FR program (p = 0.03).

Attendance effects were larger for students who were assigned to a higher baseline reading group (CVC) than for students assigned to a lower baseline reading group (Letter), and larger for boys than for girls. However, the differences in subgroup effect sizes were not statistically significant.

Figure 5 shows the effect of the FR program on average attendance (SPM and SL) for all students and for priority subgroups.

Figure 5: Effect of FR on average attendance (SPM and SL)

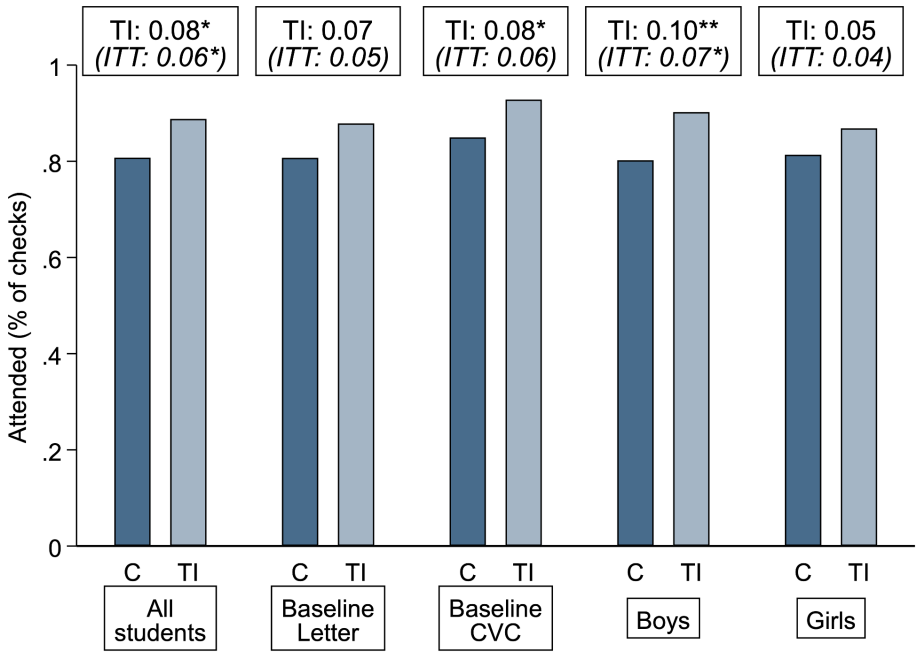
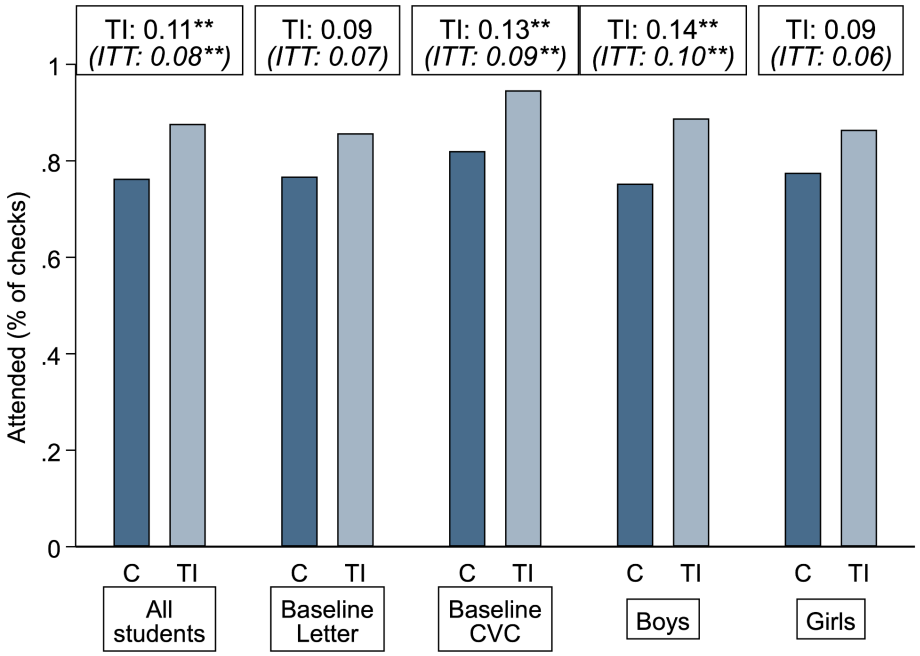


Figure 6 shows the effect of the FR program on average attendance, using only

data from SPM checks.

Figure 6: Effect of FR on average attendance (SPM only)



3.4 Other non-academic outcomes

3.4.1 Perceptions of schooling and reading

The differences in students' perceptions of school and reading across treatment and control groups were inconclusive. Although students who received the FR program were slightly more likely to report liking school and liking reading in school, the differences with the control group were not significant. **Table 3** shows the effect of FR on non-academic outcomes.

Curiously, students assigned to treatment schools were 7.3 percentage points less likely to report reading at home than students assigned to the control group (p = 0.05). This difference grows to 12.1 percentage points when we compare students exposed to the full FR program versus students exposed to none of the FR program. In particular, female students assigned to treatment schools were less likely to report practising reading (p = 0.003).

Table 3: Non-academic outcomes

	Control mean	ITT effect	Treat intensity effect
Perceptions of school & reading			
% like school	88.0%	4.3%	7.1%
% like reading in school	83.8%	1.2%	2.0%
% has friends in class	97.5%	0.4%	0.6%
Reading behaviour			
% reads at home	84.6%	-7.3%*	-12.1%*
% parents help with homework	81.7%	0.9%	1.6%

Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4. Discussion

Although the program was evaluated in its first year, results from this RCT showed that FR had modest effects on reading proficiency. Considering non-compliance in treatment and control schools, we estimate that a student exposed to the full FR program would gain 0.12 more reading levels (out of three levels) than a student who receives none of the FR program ($p = 0.10$). Given low growth in reading proficiency in the control group, this modest effect represents a relatively more impressive 0.28 SD or 36% improvement over the status quo. The FR program also had a positive impact on school attendance: students exposed to the full FR program were 11.4 percentage points more likely to be present for attendance checks by SPMs than students in the control group.

The FR program did not crowd out math instruction, and did not have significant effects on- students' enjoyment of school or reading. Curiously, students exposed to the full FR program were 12.1 percentage points less likely to report practising reading at home compared to students who received none of the program ($p = 0.05$). We do not have data to inform why this may have occurred. One possible reason may be that FR students spent more time reading at school (at least 1 hour extra of school in every treatment school), and so they needed to focus on other subjects (like math) in their homework to compensate. Given that math proficiency does not suffer, while there are modest improvements in reading, this seems to be an effective tradeoff.

Other possible but less likely reasons for why FR students spent less time reading at home may include the following:

- Teachers in FR schools give students less reading homework because they acknowledge a better, more intense reading content in schools and deem homework not necessary.
- Normal reading instruction is replaced with FR. FR materials do not contain/require any homework, while the standard reading curriculum does have homework activities.
- Students or parents in the FR program may not have had access to appropriate reading homework that corresponded to the new curriculum.
- Parents may not have known how to support children with FR homework that relied on an unfamiliar phonics-based approach to reading.

In addition to spending less time on reading at home, we note a few other FR implementation challenges that were highlighted in RAN's process evaluation and surveys of teachers and school leaders. We think that addressing these

challenges could help RAN build on the modest impact from the first iteration of the program, which they aim to improve on using insights generated from this evaluation. **Table 4** shows the FR implementation challenges and opportunities for greater impact.

Table 4: FR implementation challenges and opportunities for greater impact

Challenges	Opportunities
Crowding out reading practise at home (as noted above)	**Understand the drivers of this difference**. Tweak how RAN assigns FR-based homework or supports children and parents in reading at home.
Insufficient teacher training on FR. RAN's PE flagged insufficient training as a key barrier to the program. In end-of-year teacher surveys, 36% of teachers reported that they at least sometimes did not feel that they were sufficiently trained to deliver FR; we suspect that the true proportion may be higher, as some teachers would feel pressure to provide an agreeable response. Among the 70 teachers who provided critical feedback on the program, 1/3 cited insufficient training as the key constraint.	**Provide more initial training, more frequent retrainings and ongoing coaching**. During our field visits, some SPMs also cited variation in teachers' ability to deliver FR. There may be opportunities to leverage teacher-to-teacher training (peer learning), or train-the-trainer models across and within schools.
Insufficient student materials, particularly student workbooks. Among teachers who provided critical feedback on the program, 20% cited insufficient materials as the key constraint.	**Strengthen delivery of on-time materials to schools**.
Limited tailoring of instruction. One of the theoretical advantages of the FR curriculum is that students are assessed and placed into homogeneous reading groups and teachers tailor instructions to those groups. However, depending on the number of teachers available, schools may have adapted FR to only allow upto 2 reading levels rather than 4 (Letter, CVC, Word 1 and Word 2), which may limit the advantages of tracking students..	It may be useful to **explore ways to expand the assessment to capture more intermediate reading competencies, and/or school staffing structures that would accommodate smaller and more homogenous FR groups**. We hesitate to recommend this since there may be staffing challenges to increasing the number of FR groups per school. However, if more grades participate in FR per school than in the previous iteration, it may be possible to combine students from multiple grades into FR groups, and thus free up teachers and have a wider range of FR levels represented in the school.

We encourage RAN to add their insights to this list and other opportunities that they have observed from this first year of implementing FR.

Finally, we highlight some limitations with the evaluation that may be leading us to underestimate or overestimate the impact of the FR program.

Limitations of the RCT

1. **Non-compliance adjustments**. As noted above, we make certain assumptions about how to model non-compliance in our treatment intensity estimator. If treatment effects do not scale linearly with treatment exposure, if there is selection bias in how schools decided to implement a certain number of FR cycles, or if the school-level data on FR implementation from SPMs was inaccurate, then our TI estimates may over- or under-estimate the true impact of the program. Moreover, it may be that some students were exposed to FR materials even if their schools did not implement any FR cycles. We did not adjust for this as we hypothesised that such effects would be small and we would not be able to accurately capture the amount of exposure. If however students in these schools did benefit a lot from FR materials, then we would fail to capture that in our treatment effect estimates.
2. **Attrition**. Student response rates at endline (85%) were lower than our target (90%) and the difference between the treatment group response rate (12%) and the control group response rate (18%) was marginally statistically significant ($p = 0.06$). Although the endline sample remained well-balanced on baseline characteristics (Appendix **Table A1**), there may be unobservable characteristics that are correlated with the propensity for students to drop out and their reading proficiency, which may lead us to overestimate or underestimate impact. We present attrition-robust estimators in Appendix **Tables A11** and **A12**; although these are consistent with our top-line findings, they have large confidence intervals, indicating that attrition may be reducing the precision of our impact estimates.
3. **Assessment limitations**. We used the same tool to measure reading proficiency as teachers and SPMs used to assess and group students. While this tool is based off of the extensively-used and validated ASER assessment, it is a coarse assessment that captures a limited number of reading competencies. If students gained skills between competencies, we may fail to fully account for reading gains. For instance, there is one skill that is included in the assessment between Letter level and CVC level - Beginner Sounds - which does not impact the reading level that a student is assigned. We do see evidence of gains in this competency among treatment students relative to control students (see Appendix **Table A6**), which are not captured in the reading levels assigned to students. There may be other intermediate skills where students are gaining proficiency.

Despite these challenges in implementation and measurement, FR appears to

have a modest impact on reading proficiency. Teachers and School Leaders are quite optimistic about the program: In end-of-year surveys, 92% of teachers reported that the program was having a large positive impact on reading- “Definitely, all of the time” (66%) and “Probably, most of the time” (26%). As shown in Appendix E, we believe that the program has the potential to be a cost-effective approach to improving foundational reading. We believe that the first year implementation of the program provides a solid foundation to build on, with opportunities to strengthen the program and improve reading proficiency of over-age ECE students.

5. Appendices

Appendix A: References

Gerber, S.A., & Green, P.D., 2012. *Field Experiments: Design, Analysis, and Interpretation*. New York: W.W. Norton.

J-PAL., 2019. *Tailoring instruction to students' learning levels to increase learning*. https://doi.org/10.31485/pi.2522.2019.

McKenzie, D., 2012. *Beyond baseline and follow-up: The case for more T in experiments*. Journal of Development Economics 99, no. 2, pp. 210-221.

Appendix B: Tables

Table A1 reports average values for treatment and control across variables used in stratification and other characteristics of students and schools. Treatment and control schools appeared well-balanced across these variables. These variables were included as covariates in the endline regression analysis. The initial randomization of schools remained well-balanced on the baseline and endline learning levels and other relevant characteristics.

Table A1: Balance checks on baseline characteristics across treatment and control groups

	Baseline sample			Endline sample		
	Treatment	Control	p-value	Treatment	Control	p-value
Student-level characteristics (at baseline)						
Baseline FasterReading level (1, 2, 3)	1.49	1.51	0.69	1.50	1.51	0.86
Female	47.5%	47.0%	0.82	47.5%	46.8%	0.78
Age of student	8.97	8.89	0.60	8.94	8.88	0.65
School-level characteristics (at baseline)						
Number of over-age ECE students	40.49	32.81	0.17	(no schools dropped out of the evaluation between baseline and endline)		
Number of teachers in the whole school	8.00	7.70	0.56			
Over-age ECE student-teacher ratio	5.15	4.32	0.18			
Year RAN took over management of the school (Year 1 = 2016)	3.41	3.32	0.77			

Table A2: Descriptive statistics

	All	Treatment	Control
Reading level (baseline)			
Average level	1.50	1.49	1.51
Average Letter correct (out of 10)	5.80	5.70	5.93
Average Beginning sound correct (out of 3)	0.87	0.83	0.91
% Letter pass	49.9%	49.3%	50.7%
% Beginner sound 'pass'	27.7%	26.0%	29.7%
% CVC pass	0.1%	0.1%	0.2%
Reading level (endline)			
Average level	1.87	1.89	1.84
Average Letter correct (out of 10)	8.39	8.43	8.33
Average Beginning sound correct (out of 3)	1.62	1.69	1.53
% Letter pass	83.0%	84.1%	81.5%
% Beginner sound 'pass'	55.0%	58.7%	50.2%
% CVC pass	3.6%	4.6%	2.3%
Reading growth			
Average growth	0.36	0.39	0.33
% moved up	37.7%	39.3%	35.6%
% stayed same	59.4%	58.1%	61.1%
% went down	2.9%	2.6%	3.3%
Math problems			
Average correct (out of 4)	2.87	2.92	2.80
% recognized 12	66.9%	68.3%	65.1%
% recognized 15	63.4%	65.4%	60.7%

	All	Treatment	Control
% recognized 18	61.1%	62.4%	59.3%
% counted beans	95.5%	95.8%	95.1%
Attendance rate			
SPM & SL[8]	84.7%	87.3%	80.8%
SPM only	81.7%	85.5%	76.3%
SL only	88.3%	89.1%	87.0%
Perceptions of school & reading			
% like school	90.4%	92.2%	88.0%
% like reading in school	84.6%	85.2%	83.8%
% has friends in class	97.4%	97.3%	97.5%
Reading behaviour			
% reads at home	81.8%	79.6%	84.6%
% parents help with homework	82.0%	82.2%	81.7%

Table A3: Reading results

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
All students	1.84	0.07	0.14	0.12	0.10
Baseline Letter	1.70	0.09	0.19	0.15	0.14
Baseline CVC	1.97	0.06	0.14	0.09	0.12
Boys	1.86	0.09	0.10	0.15	0.07
Girls	1.82	0.05	0.29	0.08	0.25
Year RAN took					

[8] This is a combination of SPM and SL attendance data

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
over management of the school					
Year 1 (2016)	1.94	0.02	0.83	0.02	0.79
Year 2 (2017)	1.84	-0.05	0.44	-0.14	0.54
Year 4 (2019)	1.82	0.17	0.01	0.24	0.01
Year 5 (2020)	1.91	-0.22	0.26	-0.23	0.19

Table A4: Reading results in SDs

	ITT effect	p-value	Treat intensity effect	p-value
All students	0.17	0.14	0.28	0.10
Baseline Letter	0.21	0.19	0.35	0.14
Baseline CVC	0.14	0.14	0.22	0.12
Boys	0.21	0.10	0.36	0.07
Girls	0.11	0.29	0.19	0.25

Table A5: Reading results ToT bounds

	Control mean	TOT (lower bound)	p-value	TOT (upper bound)	p-value
All students	1.84	0.11	0.10	0.19	0.10
Baseline Letter	1.70	0.13	0.13	0.23	0.14
Baseline CVC	1.97	0.09	0.13	0.16	0.13
Boys	1.86	0.14	0.08	0.25	0.07

	Control mean	TOT (lower bound)	p-value	TOT (upper bound)	p-value
Girls	1.82	0.07	0.24	0.13	0.26

Table A6: Other reading outcomes

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
% moved up	35.6%	4.8%	0.20	8.0%	0.16
% Letter pass	81.5%	5.0%	0.20	8.3%	0.15
# Letter correct (out of 10)	8.33	0.30	0.23	0.49	0.19
% Beginner sound 'pass'	50.2%	6.2%	0.15	10.3%	0.13
# Beginning sound correct (out of 3)	1.53	0.10	0.35	0.16	0.33
% CVC pass	2.3%	1.8%	0.35	2.9%	0.35

Table A7: Math results (replication of Graph 2)

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
All students	2.80	0.13	0.51	0.21	0.48
Baseline Letter	2.44	0.04	0.87	0.08	0.86
Baseline CVC	3.15	0.18	0.17	0.29	0.12
Boys	2.91	0.08	0.65	0.14	0.63
Girls	2.68	0.18	0.41	0.30	0.36

Table A8: Other math outcomes

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
% recognized 12	65.1%	2.5%	0.67	4.1%	0.66
% recognized 15	60.7%	5.3%	0.43	8.8%	0.39
% recognized 18	59.3%	4.1%	0.51	6.8%	0.49
% counted beans	95.1%	0.9%	0.44	1.6%	0.43

Table A9: Attendance results (replication of Graphs 3 & 4)

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
Attendance rate (SPM & SL)					
All students	80.8%	6.1%	0.09	8.1%	0.07
Baseline	80.7%	5.4%	0.16	7.2%	0.14

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
Letter					
Baseline CVC	80.8%	6.0%	0.14	7.9%	0.10
Boys	80.2%	7.4%	0.07	10.0%	0.04
Girls	81.4%	4.2%	0.27	5.5%	0.24
Attendance rate (SPM only)					
All students	76.3%	8.3%	0.04	11.4%	0.03
Baseline Letter	76.8%	6.7%	0.14	9.0%	0.12
Baseline CVC	75.9%	9.1%	0.04	12.6%	0.01
Boys	75.3%	9.8%	0.03	13.5%	0.01
Girls	77.6%	6.5%	0.16	8.9%	0.14

Table A10: Non-academic outcomes subgroups

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
% like school					
All students	88.0%	4.3%	0.18	7.1%	0.20
Baseline Letter	87.1%	4.1%	0.26	7.0%	0.28
Baseline CVC	88.9%	4.1%	0.21	6.7%	0.22
Boys	89.1%	3.1%	0.30	5.2%	0.31
Girls	86.8%	5.8%	0.13	9.5%	0.15
% like reading in school					
All students	83.8%	1.2%	0.71	2.0%	0.71

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
Baseline Letter	82.3%	0.3%	0.94	0.4%	0.94
Baseline CVC	85.1%	1.5%	0.62	2.5%	0.62
Boys	84.3%	2.7%	0.41	4.4%	0.41
Girls	83.1%	-0.2%	0.96	-0.3%	0.96
% has friends in class					
All students	97.5%	0.4%	0.74	0.6%	0.73
Baseline Letter	97.5%	0.0%	1.00	0.0%	1.00
Baseline CVC	97.4%	0.9%	0.45	1.5%	0.43
Boys	98.1%	-0.1%	0.91	-0.2%	0.91
Girls	96.8%	1.0%	0.47	1.7%	0.45
% reads at home					
All students	84.6%	-7.3%	0.05	-12.1%	0.05
Baseline Letter	81.7%	-7.7%	0.11	-13.1%	0.13
Baseline CVC	87.3%	-5.9%	0.10	-9.5%	0.08
Boys	83.4%	-3.5%	0.44	-5.8%	0.44
Girls	85.9%	-11.4%	0.00	-18.7%	0.00
% parents help with homework					
All students	81.7%	0.9%	0.75	1.6%	0.74
Baseline Letter	80.3%	1.1%	0.78	1.9%	0.77
Baseline CVC	83.0%	0.8%	0.81	1.2%	0.81

	Control mean	ITT effect	p-value	Treat intensity effect	p-value
Boys	80.0%	3.5%	0.29	5.8%	0.27
Girls	83.5%	-1.8%	0.61	-2.9%	0.61

Table A11: Reading results, IPW

	Control mean	ITT effect	p-value	Treat intensity effect	p-value	IPW	p-value
All students	1.84	0.07	0.14	0.12	0.10	0.05	0.33
Baseline Letter	1.70	0.09	0.19	0.15	0.14	0.05	0.46
Baseline CVC	1.97	0.06	0.14	0.09	0.12	0.05	0.27
Boys	1.86	0.09	0.10	0.15	0.07	0.06	0.27
Girls	1.82	0.05	0.29	0.08	0.25	0.03	0.52

Table A12: Reading results, Lee Bounds

	Control mean	Upper bound	p-value	Lower bound	p-value
All students	1.84	0.10	0.00	-0.01	0.67
Baseline Letter	1.70	0.11	0.00	0.01	0.68
Baseline CVC	1.97	0.10	0.00	-0.03	0.12

Note: Lee Bounds could not be constructed for only male students and only female students.

Appendix C: Regression specification

The primary question of this study looks at changes in ECE students learning outcomes. The effect of the FR program on student performance in literacy assessments was estimated using the following Ordinary Least Squares model:

$$Y_{ij}^{*} = \beta_1 T_j + X'_{ij}\gamma + \alpha'_s + \varepsilon_{ij}$$

Where:

- $\mathbf{Y_{ij}}$ denotes the outcome variable (reading score, enrolment, attendance) for student *i* in school *j*
- $\mathbf{T_j}$ denotes the treatment status of school *j* (1 for treatment group; 0 for control group)
- $\boldsymbol{\beta_1}$ is the estimated treatment effect of FR compared to control
- $\mathbf{X'_{ij}}$ is a vector of student-level covariates, including ECE baseline reading score, binary variable for female students, and age at baseline, as well as school-level covariates such as year of RAN takeover and over-age ECE student-teacher ratio
- $\boldsymbol{\gamma}$ is a vector of coefficients for the included covariates
- $\boldsymbol{\alpha'_s}$ is a vector of categorical factors corresponding to the stratum that the student is found in i.e. school-average baseline FR level of over-age ECE students; over-age ECE student: teacher ratio; and year that RAN took over the school
- $\boldsymbol{\varepsilon_{ij}}$ denotes the student error term *i*, clustered at the school-level *j* to reflect the randomization process

We used the Analysis of covariance (ANCOVA) estimator because it has more statistical power than the difference-in-difference estimator.[9]

[9] McKenzie, David. "Beyond baseline and follow-up: The case for more T in experiments." Journal of Development Economics 99, no. 2 (2012): 210-221.

Appendix D: Endline survey instrument

ECE Evaluation: Endline (STUDENT)

RISING ACADEMY NETWORK

Letter Names

E	N	A	P	J
o	i	h	v	f

Beginning Sounds

CVC Words

tab	sip	hop	pad
dim	mat	fix	red

Words with Blends

slap	clip	blob	limp
lamp	raft	stamp	drift

Sentence

Janet helped her dad paint the kitchen. She got covered in white marks.

Developed from materials created by the ASER Center

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ECE Evaluation: Endline (STUDENT)

RISING ACADEMY NETWORK

Story

It is John's birthday. He is 8 years old. He is having a party. John has asked two friends to come to his party. Their names are Nelson and Prince.
John is waiting for Nelson and Prince to come. They will play games and sing songs. Then they will read a story. After the story Nelson and Prince will go home.

Developed from materials created by the ASER Center

असर ASER

READING INSTRUCTIONS: Endline (ASSESSOR)

RISING ACADEMY NETWORK

Letter Names

Today we are going to do some reading activities. Just relax and feel free. Take your time and try your best. Point to the letters and tell me the name. **Record the # of letters read incorrectly and move to Beginning Sounds**

E	N	A	P	J
o	i	h	v	f

Beginning Sounds

Now we are going to play a listening game about the sounds at the beginning of a word.
*The word **cat** starts with the /c/ sound. Listen to the words I say and tell me which one starts with the same sound /c/ like cat.*

*mouse, **cup**, friend In this one, cat and cup both have the /c/ sound at the beginning!*

***Q1**. Let's do another one. Ready? **name** starts with the **/n/** sound. Now listen to these words and tell me which one starts with the /n/ sound like name.*

*baby, toes, **neck***

***Q2**. Let's do another one. Ready? **pen** starts with the **/p/** sound. Now listen to these words and tell me which one starts with the /p/ sound like pen.*

*sat, **pig**, man*

***Q3**. Let's do another one. Ready? **hat** starts with the **/h/** sound. Listen to these words and tell me which one starts with the /h/ sound like hat.*

***head**, feet, rat*

Record the # of incorrect answers and move to CVC Words

CVC Words

Next, I have some words for you to read. You can use what you know about blending sounds to read them.

tab	sip	hop	pad
dim	mat	fix	red

Record # of incorrect answers. If the students makes more than 2 mistakes, STOP the assessment.

Words with Blends

Next, I have some longer words for you to read. You can use what you know about blending sounds to read them.

slap	clip	blob	limp
lamp	raft	stamp	drift

Record # of incorrect answers. If the students makes more than 2 mistakes, STOP the assessment.

Sentence

Next, I have some sentences for you to read. You can use what you know about blending sounds to read them.

Janet helped her dad paint the kitchen.
She got covered in white marks.

Record # of mistakes. More than 3 mistakes, STOP the assessment.

READING INSTRUCTIONS: Endline (ASSESSOR)

RISING ACADEMY NETWORK

Story Reading

Next, please read this Story for me.

It is John's birthday. He is 8 years old. He is having a party. John has asked two friends to come to his party. Their names are Nelson and Prince.
John is waiting for Nelson and Prince to come. They will play games and sing songs. Then they will read a story. After the story Nelson and Prince will go home.

Listen to the child read the passage and record the number of mistakes.
If the child makes more than 3 mistakes, STOP the assessment

Story Comprehension

Next, please answer these questions.

Q1: *Who came to John's party?*
Q2: *Why is John having a party?*

Example answers

A1:	A2:
Two friends	It is his birthday.
Nelson and Prince	John is celebrating his birthday.

Record # of incorrect answers.

0 = Both answers correct.,
1 = 1 answer incorrect, 1 answer correct
2 = 2 answers incorrect

ECE Evaluation: Endline (STUDENT)

RISING ACADEMY NETWORK

Number recognition

15 18 12

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ECE Evaluation: Endline (STUDENT)

RISING ACADEMY NETWORK

Sad

So-so

Happy

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Appendix E: Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) is typically reserved for interventions with strong evidence of impact. In J-PAL's list of interventions that improve student learning (link), for instance, the authors only report cost-effectiveness for interventions that have statistically significant treatment effects at the 10% level of significance. Our findings from the RCT of the FR program do not quite meet this burden of proof: the ITT estimate on our primary outcome has a p-value of 0.14, and the Treatment Intensity estimate p-value is slightly above 0.10 (moreover, the TI estimator relies on stronger assumptions than the typical ITT used in CEA). Nevertheless, we use our TI estimator - our best guess at the impact of the full program - to give suggestive evidence on the potential cost-effectiveness of FR, if the program were implemented according to plan.

Approach to CEA

We estimate the cost-effectiveness of the FR program for over-age ECE students. This is a somewhat conservative estimate since some of the costs are incurred at the school-level, and thus would not scale proportionally if FR were implemented in upper grades (Grades 3-6, as envisioned). We focus on over-age ECE students for two reasons. First, from our evaluation we only have impact estimates for over-age ECE students and not for other grades - any extrapolation of impact from over-age ECE to others would require strong assumptions. Second, not all schools have been implementing FR to Grades 3-6 due to capacity constraints (lack of teachers and/or lack of training), so it does not appear that RAN could implement FR to other students and grades without significant additional investment in teacher training or hiring.

We separate out the fixed start-up costs of the FR program (e.g. curriculum development) from the costs that would be incurred in future implementation (trainings, materials, etc.), and only include the latter in our CE estimate. We exclude any costs that would be incurred in the course of normal school programming, including teacher and staff salaries. We also exclude costs associated with COVID-induced lockdowns and restarting the program, including refresher trainings.

Our calculation follows the standard approach applied by J-PAL and other researchers to estimate the cost-effectiveness of education programs:

100(# students in FR*Avg impact on learning per student in standard deviations)/(Total cost of FR in USD) = Learning gains (in SDs) per USD $100 spent*

Inputs to CEA

We solicited the cost of inputs from the RAN team and describe these below, along with any adjustments that we made:

- Training of RPMs & SPMs: $8,000
- Training of all teachers: $44,000. ECE teachers are ~⅓ of the workforce, and the treatment group is ~½ of all ECE teachers. Since training costs scale proportional to trainees, we estimate training of ECE teachers in the treatment group = ⅙ * 44,000 = $7,333
- Material costs for over-age ECE implementation: $10,000. Delivery costs: $8,000. Additional printing costs for student assessments after each cycle: $500
- No additional staffing costs to implement FR
- Total cost: $8,000 + $7,333 + $10,000 + $8,000 + $500 = $33,833

CEA calculation

- Number of over-age ECE students that received the program in the treatment group, scaled according to the amount of the program that each received:[10] 675*1 + 396*0.8 + 119*0.6 + 73*0.4 + 80*0.2 + 155*0 = 1,108
- Impact estimate of the full 5-cycle program in SDs from Appendix **Table A4**: 0.28 SD.
- Total cost to deliver FR to over-age ECE students in the treatment group: $33,833.

CEA = 100*1108*0.28/33,833 = **0.91 SD learning gains per $100**

Comparison to other programs

Though FR is in its early stages and is yet to be iterated for improvement, this cost-effectiveness estimate is comparable to other pedagogical innovations highlighted in J-PAL's CEA of education programs.

Our cost-effectiveness estimate of FR for over-age ECE students comes with several caveats, which may be leading us to overestimate or underestimate the true cost-effectiveness of the program:

+ Extending the full program to Grades 3-6 consistently may not require a proportional increase in costs.
+ Leveraging opportunities to strengthen program implementation may increase impact.
- Strengthening program implementation may incur additional costs.
- The control group, against which treatment effects are standardised, had low average reading growth. Converting cost-effectiveness estimates to equivalent years of schooling in other contexts may lead to less

[10] For instance, a student who received 4 FR cycles is coded as receiving 80% of the program. Thus the calculation is the number of student-equivalents who received the full 5-cycle program.

favourable comparisons with other programs.

+/- The full program impact (TI estimator) is not precisely estimated (not statistically significant at the 10% level, based on additional assumptions); the true impact may be higher or lower.

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