

Online Appendix for
Implementing Home-Based Educational Interventions at Scale

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A Meta-analysis of Educational Interventions

The meta-analysis is based on data from two studies. First, studies of educational programs commissioned by EEF and NCEE are based on data from [Lortie-Forgues and Inglis \(2019\)](#). These are categorized as educational interventions. Second, studies specifically focusing on parent-aimed interventions are based on data from a systematic review of shared book reading by [Noble et al. \(2019\)](#). Following [Noble et al. \(2019\)](#), we exclude studies with effect sizes greater than three standard deviations, and we include only randomized controlled trials with standardized test outcomes in the meta-analysis.

We supplement the data on parent-aimed interventions with a systematic literature search that broadens the search criteria. The systematic search was based on the same search string as [Noble et al. \(2019\)](#) with the following addition: "caregiver*", "parent*", or "home" combined with "reading", "training", "education", "information", "implement*", "intervention", "achievement", "engagement", "text messag*", or "provid* knowledge". The systematic search was limited to studies with the words "random*", "causal", "experiment", or "impact" in the following journals: *Science*, *Proceedings of the National Academy of Sciences*, *Nature Human Behaviour*, *Journal of Economic Perspectives*, *Economics Letters*, *Journal of Human Resources*, *Economics of Education Review*, *Journal of Policy Analysis and Management*, *Journal of Public Administration Research and Theory*, *Public Administration Review*, *Annals of The American Academy of Political and Social Science*, and *Early Child Development and Care*.

A separate supplementary materials document lists all the data and references included in our meta-analysis. We will make this available as an online appendix upon publication.

B Baseline and balance

B.1 Baseline balance using full set of variables

Table B.1: Differences in mean between invited and non-invited on background characteristics. Full set of variables

	(1) Non-invited	(2) Invited	(3) 1-2	<i>p</i> -values
Child is a boy	0.52	0.52	-0.00	0.68
Child's age in 2016	8.09	8.09	0.00	0.41
Child immigrant	0.10	0.12	0.01	0.07
Child living with both parents	0.72	0.71	-0.01	0.25
Child living with single parent	0.20	0.21	0.01	0.10
Child living with parent in new relationship or not living with own parents	0.08	0.08	-0.00	0.49
No. of children in family	2.31	2.33	0.02	0.17
Mother compulsory education	0.14	0.14	0.01	0.16
Mother upper secondary education	0.05	0.05	-0.00	0.58
Mother vocational education	0.31	0.31	-0.00	0.94
Mother short-cycle education	0.05	0.05	-0.00	0.09
Mother medium-cycle education	0.27	0.27	0.00	0.97
Mother long-cycle education	0.13	0.13	-0.00	0.66
Mother employed	0.79	0.78	-0.01	0.06
Mother unemployed	0.04	0.04	0.00	0.25
Mother outside labor market	0.17	0.18	0.01	0.07
Mother's total income (1000 DKK)	263.12	256.89	-6.23	0.19
Mother's age in 2014 (years)	38.76	38.63	-0.14	0.11
Mother is teenager at date of birth	0.01	0.01	0.00	0.67
Father compulsory education	0.16	0.17	0.01	0.16
Father upper secondary education	0.06	0.05	-0.00	0.08
Father vocational education	0.41	0.41	0.00	0.97
Father short-cycle education	0.08	0.08	-0.00	0.70
Father medium-cycle education	0.14	0.13	-0.00	0.45
Father long-cycle education	0.13	0.13	-0.00	0.77
Father employed	0.88	0.87	-0.01	0.06
Father unemployed	0.03	0.03	0.00	0.40
Father outside labor market	0.09	0.10	0.01	0.05
Father's total income (1000 DKK)	387.25	375.20	-12.05	0.13
Father's age in 2014 (years)	41.31	41.21	-0.10	0.20
Father is teenager at date of birth	0.00	0.00	0.00	0.96
School size	61.11	60.49	-0.62	0.75
School average test score 2016	0.01	-0.02	-0.03	0.18

Notes: *p*-values based on standard errors clustered at the school level.

C Supplementary results

C.1 Additional results on the nationwide experiment

Table C.1: Effects on the three sub domains (Intention-to-treat)

	(1) Language comprehension	(2) Decoding	(3) Text comprehension
Invited	-0.003 (0.017)	0.010 (0.020)	0.004 (0.019)
Constant	0.913** (0.148)	1.783** (0.147)	1.072** (0.137)
Observations	51030	51030	51030
Schools (clusters)	1130	1130	1130
Adjusted R-squared	0.123	0.117	0.117
Wave Indicators	Yes	Yes	Yes
LASSO Covariates	Yes	Yes	Yes

Notes: Models estimated with OLS. Standard errors clustered at the school level in parentheses.

Table C.2: Effects on the three recruitment waves
(Intention-to-treat)

	(1) Danish reading - Total score
Wave=1	-0.014 (0.031)
Wave=2	-0.013 (0.034)
Wave=3	-0.014 (0.041)
Observations	51312
Schools (clusters)	1140
Mean control group	0.006
Adjusted R-squared	-0.000

Notes: Models estimated with OLS. Standard errors clustered at the school level in parentheses.

Table C.3: Participants vs non-participants (excluding Aarhus).
Difference-in-difference estimates on students' reading skills. Total score
(OLS)

	(1) Total score	(2) Total score	(3) Total score
Post treatment	-0.009 (0.011)	-0.009 (0.011)	-0.012 (0.010)
Participating X Post treatment	0.036 (0.032)	0.036 (0.032)	0.050 (0.031)
Constant	-0.022* (0.011)	0.003 (0.003)	1.734** (0.089)
Observations	150685	150685	150685
Schools (clusters)	1123	1123	1123
Adjusted R-squared		0.000	0.115
Fixed Effects	No	Yes	Yes
LASSO Covariates	No	No	Yes

Notes: Standard errors clustered at the school level in parentheses. Different specifications reported in Appendix C.

C.2 Causal Forest Analysis of heterogeneous effects

To further examine possible heterogeneous treatment effects we use the Causal Forest analysis by [Wager and Athey \(2018\)](#). Figure C.1 shows the Out-of-bag conditional average treatment effect (CATE). A few students have large either positive or negative predicted effects. However, when we use the omnibus test proposed by [Chernozhukov et al. \(2018\)](#) (see Table C.4), we obtain large p-values, which suggest either that the forest does not capture heterogeneity well, or that there is not much heterogeneity.

Figure C.1: Causal forests: out-of-bag CATE

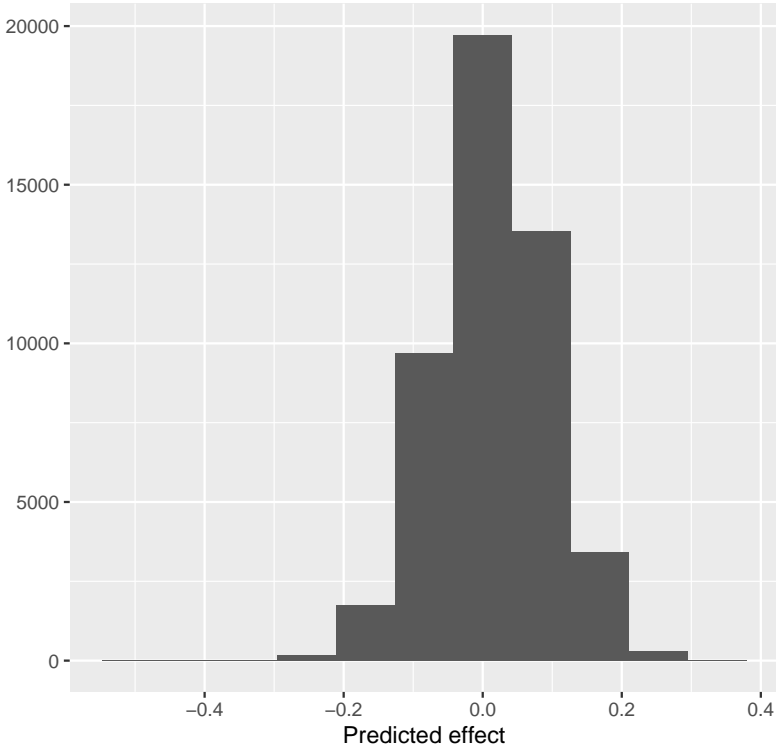


Table C.4: Omnibus test

	Estimate	Pr(>t)
Mean Forest Prediction	0.827 (1.463)	.286
Differential Forest Prediction	-0.373 (0.180)	.981

Note: The table shows estimates for the omnibus test inspired by [Chernozhukov et al. \(2018\)](#) and implemented through the `test_calibration` function from the `grf` library in R. (Standard errors in parentheses)

C.3 Difference-in-Differences analyses of local replication experiment

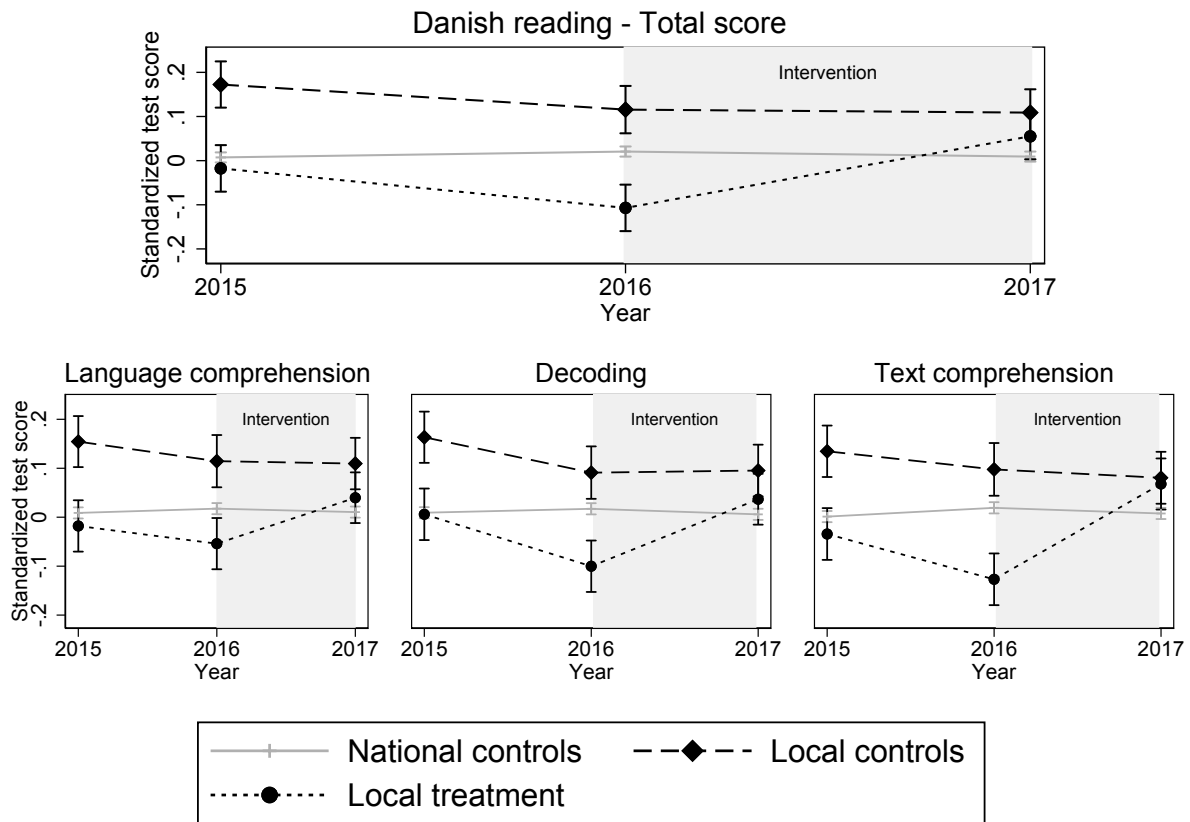


Figure C.2: Effect of READ in observational replication study on total, composite reading test score and three subscales

Table C.5: Total score

	(1)	(2)	(3)
Not READ	0.076 (0.055)		
Not READ Aarhus	0.207 (0.073)		
Post READ	0.117 (0.073)	0.133 (0.070)	0.103 (0.071)
Not READ X Post READ	-0.122 (0.074)	-0.139 (0.071)	-0.113 (0.072)
Not READ Aarhus X Post READ	-0.153 (0.095)	-0.176 (0.091)	-0.153 (0.091)
Mean of control	-0.062	-0.062	-0.062
Observations	96965	96965	96965
Schools (clusters)	699	699	699
Adjusted R-squared	0.001	0.000	0.116
Fixed Effects	No	Yes	Yes
Covariates	No	No	Yes

Notes: Standard errors clustered at the school level in parentheses. The full list of the included covariates is reported in Table 3.

Table C.6: Language comprehension

	(1)	(2)	(3)
Not READ	0.049 (0.048)		
Not READ Aarhus	0.171 (0.064)		
Post READ	0.076 (0.057)	0.092 (0.054)	0.068 (0.053)
Not READ X Post READ	-0.078 (0.058)	-0.096 (0.056)	-0.071 (0.054)
Not READ Aarhus X Post READ	-0.101 (0.083)	-0.123 (0.081)	-0.102 (0.079)
Mean of control	-0.036	-0.036	-0.036
Observations	96965	96965	96965
Schools (clusters)	699	699	699
Adjusted R-squared	0.001	0.000	0.092
Fixed Effects	No	Yes	Yes
Covariates	No	No	Yes

Notes: Standard errors clustered at the school level in parentheses. The full list of the included covariates is reported in Table 3.

Table C.7: Decoding

	(1)	(2)	(3)
Not READ	0.060 (0.053)		
Not READ Aarhus	0.175 (0.072)		
Post READ	0.084 (0.076)	0.097 (0.073)	0.070 (0.074)
Not READ X Post READ	-0.091 (0.077)	-0.104 (0.074)	-0.085 (0.075)
Not READ Aarhus X Post READ	-0.117 (0.092)	-0.138 (0.088)	-0.119 (0.088)
Mean of control	-0.047	-0.047	-0.047
Observations	96965	96965	96965
Schools (clusters)	699	699	699
Adjusted R-squared	0.001	0.000	0.092
Fixed Effects	No	Yes	Yes
Covariates	No	No	Yes

Notes: Standard errors clustered at the school level in parentheses. The full list of the included covariates is reported in Table 3.

Table C.8: Text comprehension

	(1)	(2)	(3)
Not READ	0.091 (0.050)		
Not READ Aarhus	0.197 (0.064)		
Post READ	0.149 (0.067)	0.161 (0.064)	0.133 (0.067)
Not READ X Post READ	-0.151 (0.068)	-0.163 (0.066)	-0.142 (0.068)
Not READ Aarhus X Post READ	-0.185 (0.088)	-0.201 (0.085)	-0.179 (0.086)
Mean of control	-0.081	-0.081	-0.081
Observations	96965	96965	96965
Schools (clusters)	699	699	699
Adjusted R-squared	0.001	0.000	0.093
Fixed Effects	No	Yes	Yes
Covariates	No	No	Yes

Notes: Standard errors clustered at the school level in parentheses. The full list of the included covariates is reported in Table 3.

Table C.9: PLACEBO test of Difference-in-difference estimates on students' reading skills. Using 2016 as treatment year. Total score and the three subdomains (OLS)

LOCAL CONTROL GROUP				
	(1)	(2)	(3)	(4)
	Total score	Language comprehension	Decoding	Text comprehension
Placebo post treatment	-0.060 (0.054)	-0.046 (0.047)	-0.070 (0.052)	-0.040 (0.057)
Local treatment X Placebo post treatment	-0.026 (0.092)	0.013 (0.072)	-0.033 (0.089)	-0.049 (0.096)
Constant	0.077** (0.023)	0.068** (0.018)	0.083** (0.022)	0.050* (0.024)
Observations	5494	5494	5494	5494
Schools (clusters)	46	46	46	46
Adjusted R-squared	0.001	0.000	0.002	0.001
Fixed Effects	Yes	Yes	Yes	Yes
NATIONAL CONTROL GROUP				
	(1)	(2)	(3)	(4)
	Total score	Language comprehension	Decoding	Text comprehension
Placebo post treatment	0.011 (0.015)	0.008 (0.013)	0.004 (0.015)	0.015 (0.015)
Local treatment X Placebo post treatment	-0.096 (0.075)	-0.041 (0.056)	-0.107 (0.073)	-0.105 (0.078)
Constant	0.007 (0.007)	0.008 (0.006)	0.011 (0.007)	0.001 (0.007)
Observations	61734	61734	61734	61734
Schools (clusters)	676	676	676	676
Adjusted R-squared	0.000	-0.000	0.000	0.000
Fixed Effects	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the school level in parentheses.

C.4 Robustness of Implementation Analyses

Table C.10: Baseline balance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Invite, not part	Lower third	Middle third	Upper third	1-2	1-3	1-4
Student level							
Child is a boy	0.51	0.52	0.53	0.53	-0.01 (0.69)	-0.02 (0.09)	-0.02 (0.15)
Child's age (2016)	8.09	8.08	8.09	8.09	0.01 (0.31)	0.00 (0.92)	0.01 (0.69)
Child immigrant	0.11	0.17	0.10	0.09	-0.06 (0.02)	0.01 (0.37)	0.03 (0.18)
Mother compulsory education (2014)	0.14	0.17	0.14	0.14	-0.03 (0.06)	-0.00 (0.92)	0.01 (0.55)
Mother upper secondary education (2014)	0.06	0.05	0.05	0.05	0.01 (0.21)	0.01 (0.21)	0.00 (0.55)
Mother vocational education (2014)	0.30	0.30	0.32	0.34	-0.00 (0.95)	-0.01 (0.48)	-0.04 (0.08)
Mother short-cycle education (2014)	0.05	0.04	0.05	0.05	0.01 (0.10)	0.00 (0.60)	-0.00 (0.87)
Mother medium-cycle education (2014)	0.27	0.25	0.28	0.29	0.02 (0.19)	-0.01 (0.42)	-0.01 (0.25)
Mother long-cycle education (2014)	0.13	0.13	0.12	0.10	0.01 (0.79)	0.01 (0.51)	0.03 (0.15)
Father compulsory education (2014)	0.17	0.18	0.17	0.15	-0.01 (0.34)	-0.00 (0.92)	0.01 (0.39)
Father upper secondary education (2014)	0.05	0.05	0.05	0.05	0.00 (0.40)	0.01 (0.29)	0.00 (0.54)
Father vocational education (2014)	0.40	0.41	0.42	0.46	-0.01 (0.60)	-0.03 (0.18)	-0.07 (0.01)
Father short-cycle education (2014)	0.08	0.07	0.08	0.08	0.00 (0.59)	-0.01 (0.24)	-0.01 (0.36)
Father medium-cycle education (2014)	0.14	0.12	0.13	0.13	0.02 (0.22)	0.01 (0.59)	0.00 (0.80)
Father long-cycle education (2014)	0.14	0.12	0.11	0.10	0.01 (0.59)	0.03 (0.17)	0.04 (0.04)
Missing test score (2017)	0.04	0.05	0.03	0.03	-0.02 (0.10)	0.01 (0.29)	0.00 (0.74)
School level							
School size ¹	46.36	43.23	46.59	43.89	3.13 (0.45)	-0.23 (0.96)	2.47 (0.55)
Average test score (2016) ²	-0.04	-0.13	-0.03	-0.06	0.09 (0.20)	-0.01 (0.90)	0.02 (0.76)
Students	15161	2075	2283	2063	17236	17444	17224
Schools	327	48	49	47	375	376	374

Notes: p -values in parentheses based on standard errors clustered at the school level. ¹Number of students in second grade.

²Standardized using the mean and the standard deviation from the national sample in 2017.

Table C.11: Effect of READ by Level of Implementation (Downloads). Models with and without covariates included.

	Categorical variable			Continuous variable		
	(1)	(2)	(3)	(4)	(5)	(6)
Invite, not part	-0.012 (0.027)	-0.004 (0.023)	0.002 (0.021)			
Lower third	-0.128 (0.060)	-0.072 (0.051)	-0.047 (0.046)			
Middle third	-0.004 (0.052)	0.023 (0.046)	0.025 (0.044)			
Upper third	0.074 (0.043)	0.099 (0.043)	0.114 (0.044)			
Proportion of downloads across schools				0.121 (0.092)	0.201 (0.087)	0.222 (0.091)
Girl		ref.	ref.		ref.	ref.
Child is a boy=1		-0.267 (0.009)	-0.268 (0.009)		-0.267 (0.009)	-0.268 (0.009)
Child age 7 years		ref.	ref.		ref.	ref.
8		0.043 (0.037)	0.045 (0.037)		0.047 (0.037)	0.049 (0.037)
9		-0.170 (0.041)	-0.179 (0.041)		-0.167 (0.041)	-0.175 (0.041)
10		-0.358 (0.145)	-0.406 (0.147)		-0.358 (0.145)	-0.403 (0.147)
Child immigrant=1		-0.279 (0.023)	-0.254 (0.023)		-0.280 (0.023)	-0.255 (0.023)
Child lives with both parents		ref.	ref.		ref.	ref.
Child living with single parent		-0.078 (0.012)	-0.072 (0.013)		-0.078 (0.012)	-0.072 (0.013)
Child living with parent in new relationship or not living with own parents		-0.051 (0.017)	-0.053 (0.017)		-0.049 (0.017)	-0.051 (0.017)
No. of children in family		-0.033 (0.005)	-0.031 (0.006)		-0.034 (0.006)	-0.032 (0.006)
Mother compulsory education		ref.	ref.		ref.	ref.
Mother upper secondary education (2014)		0.261 (0.023)	0.251 (0.023)		0.263 (0.023)	0.253 (0.024)
Mother vocational education (2014)		0.112 (0.016)	0.110 (0.016)		0.115 (0.016)	0.112 (0.016)
Mother short-cycle education (2014)		0.286 (0.023)	0.275 (0.023)		0.291 (0.023)	0.279 (0.023)
Mother medium-cycle education (2014)		0.340 (0.018)	0.331 (0.018)		0.344 (0.018)	0.334 (0.018)
Mother long-cycle education (2014)		0.478 (0.021)	0.457 (0.021)		0.480 (0.021)	0.459 (0.021)
Mother outside labor market		ref.	ref.		ref.	ref.
Mother unemployed		-0.034 (0.027)	-0.030 (0.027)		-0.033 (0.027)	-0.028 (0.027)
Mother employed		0.048 (0.016)	0.043 (0.016)		0.050 (0.016)	0.046 (0.016)
Mother's total income (1000 kr.)		0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)
Mother's age in 2014, y		0.003 (0.001)	0.002 (0.001)		0.003 (0.001)	0.003 (0.001)

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Table C.11 continued

Father compulsory education		ref.	ref.		ref.	ref.
Father upper secondary education (2014)		0.262 (0.022)	0.246 (0.022)		0.263 (0.022)	0.248 (0.022)
Father vocational education (2014)		0.125 (0.014)	0.119 (0.014)		0.126 (0.014)	0.120 (0.014)
Father short-cycle education (2014)		0.258 (0.020)	0.245 (0.020)		0.256 (0.020)	0.243 (0.020)
Father medium-cycle education (2014)		0.316 (0.017)	0.300 (0.017)		0.317 (0.017)	0.302 (0.017)
Father long-cycle education (2014)		0.409 (0.019)	0.382 (0.019)		0.409 (0.019)	0.384 (0.019)
Father outside labor market		ref.	ref.		ref.	ref.
Father unemployed		0.011 (0.030)	0.014 (0.030)		0.018 (0.030)	0.021 (0.030)
Father employed		0.063 (0.017)	0.058 (0.017)		0.065 (0.017)	0.059 (0.017)
Father's total income (1000 kr.)		0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.000 (0.000)
Father's age in 2014, y		-0.001 (0.001)	-0.001 (0.001)		-0.001 (0.001)	-0.001 (0.001)
Missing on Mother's education (6 categories)		0.138 (0.029)	0.134 (0.029)		0.141 (0.029)	0.138 (0.029)
Missing on Mother's employment status (3 categories)		0.174 (0.093)	0.126 (0.092)		0.172 (0.093)	0.127 (0.093)
Missing on Mother's total income (1000 kr.)		-0.237 (0.141)	-0.199 (0.139)		-0.230 (0.142)	-0.196 (0.140)
Missing on Mother's age in 2014, y		-0.179 (0.136)	-0.192 (0.136)		-0.171 (0.138)	-0.183 (0.137)
Missing on Father's education (6 categories)		0.125 (0.029)	0.104 (0.029)		0.127 (0.029)	0.106 (0.029)
Missing on Father's employment status (3 categories)		0.173 (0.088)	0.180 (0.086)		0.172 (0.089)	0.179 (0.086)
Missing on Father's total income (1000 kr.)		-0.056 (0.083)	-0.074 (0.077)		-0.053 (0.084)	-0.070 (0.078)
Missing on Father's age in 2014, y		-0.093 (0.081)	-0.086 (0.081)		-0.095 (0.082)	-0.088 (0.081)
School size			-0.000 (0.000)			-0.000 (0.000)
School average test score 2016			0.285 (0.028)			0.283 (0.027)
Constant	0.006 (0.016)	-0.387 (0.060)	-0.322 (0.064)	-0.002 (0.013)	-0.406 (0.060)	-0.339 (0.064)
Observations	51312	51312	51030	50980	50980	50698
Clusters (Schools/Municipalities)	1140	1140	1130	1133	1133	1123
Adjusted R-squared	0.001	0.139	0.150	0.000	0.140	0.150

Notes: Standard errors clustered at the school level in parentheses.

Table C.12: Effect of READ by Level of Implementation (Downloads). Proportion of downloads in 2 and 4 categories, and continuous variable with non-compliers included.

	(1) 2 categories	(2) 4 categories	(3) Continuous, incl. non-compliers	(4) Continuous, excl. no student identifiers
Invite, not part	0.002 (0.021)			
Lower half	-0.038 (0.039)			
Upper half	0.099 (0.036)			
Control group, not invited		ref.		
Invite, not part		0.002 (0.021)		
1st quarter		-0.099 (0.051)		
2nd quarter		0.013 (0.054)		
3rd quarter		0.094 (0.054)		
4th quarter		0.104 (0.042)		
Proportion of downloads across schools			0.196 (0.087)	0.224 (0.101)
Constant	-0.322 (0.064)	-0.321 (0.064)	-0.325 (0.064)	-0.343 (0.065)
Observations	51030	51030	51030	49258
Schools (clusters)	1130	1130	1130	1087
Adjusted R-squared	0.150	0.150	0.150	0.149
Student covariats	YES	YES	YES	YES
School covariates	YES	YES	YES	YES

Notes: Standard errors clustered at the school level in parentheses. Model 3 for includes non-compliers, i.e. seven schools that were not invited but participated. Model 4 excludes schools that participated, but did not grant access to student identifiers on use of app. The full list of the included covariates is reported in Table C.11.

D Supplementary Materials

Two experiments were embedded in the trial. First, as illustrated in Figure D.1 two variants of the invitation letter were sent to the schools. Second, among schools that accepted the invitations, two variance of the READ program was tested. Below we describe each of these embedded experiments. Figure D.1 contains less information than Figure 2. The purpose is to illustrate the two embedded experiments.

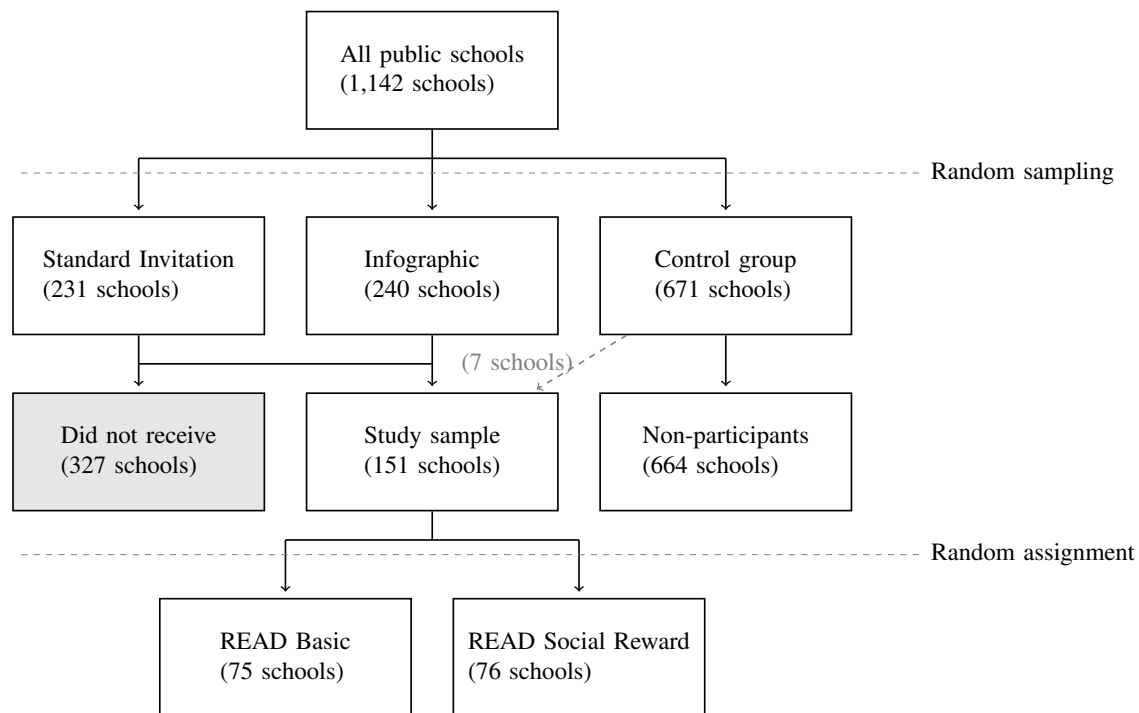


Figure D.1: Design of two embedded experiments

D.1 Invitations

To study how to encourage schools to adopt the program, we randomly assigned schools to one of two versions of the invitation letter. Both groups received an invitation from The Ministry of Education describing the program and its effects. However, since effects from randomized controlled trials may be difficult to convey to persons without a background in research, the one group of schools were assigned to an infographic illustrating the effect of the intervention as estimated in the first randomized controlled-trial in 2014. Apart from infographic, the invitations were identical.

Figure D.2 panel (a) shows the main invitation that all schools receive. Panel (b) shows the infographic that was randomly assigned to half of the schools in the invitation group.

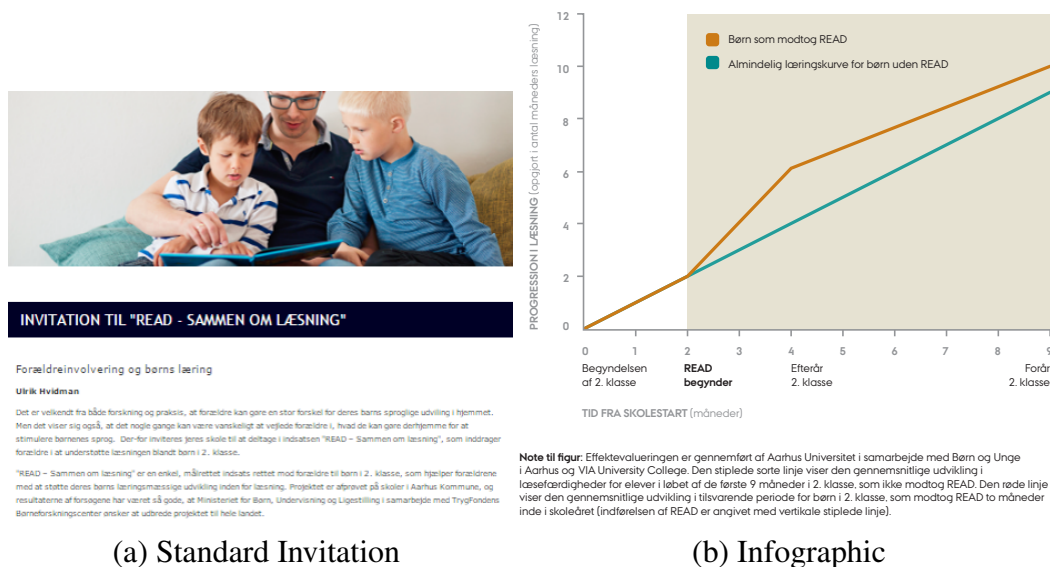


Figure D.2: Invitation email. All schools received the standard invitation. Half of the schools were randomly assigned to also receive the infographic.

Table D.1 shows that the two experimental groups in the embedded invitation experiment were balanced on major baseline characteristics.

Table D.1: Balance Invitation experiment

	(1)	(2)	(3)	
	Standard Invitation	Infographic	1-2	<i>p</i> -values
Average test score 2016	-0.05	-0.05	0.00	(0.93)
Mother high education	0.39	0.38	0.01	(0.34)
Child immigrant	0.11	0.09	0.02	(0.09)
School size	46.29	45.38	0.91	(0.70)
Observations (Schools)	231	240	471	

Table D.2 shows that the Infographic invitation did not increase participation in the READ program significantly.

Table D.2: Effect of Infographic on participation in the READ program

	(1)	(2)
Infographic	-0.063 (0.042)	-0.070 (0.043)
Mean of control	0.338	0.338
Observations (Schools)	471	468
Adjusted R-squared	0.003	0.001
Covariates	No	Yes

Notes: Standard errors in parentheses. The full list of the included covariates is reported in Table 3.

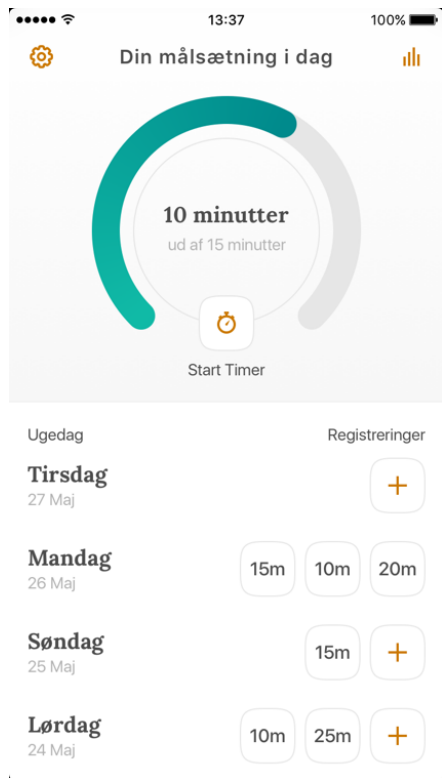
D.2 Social Rewards

Behavioral barriers may constitute a key challenge to the effectiveness of educational interventions that target families. The basic notion behind parent-aimed interventions is that parents will build a better learning environment at home. However, a rapidly growing research literature in behavioral social science has focused on understanding why people often fail to do things they know they should do. Even parents who know what steps to take to significantly improve their children’s abilities may fail to take these steps because of behavioral factors (for reviews of behavioral economics of education, see [Lavecchia, Liu and Oreopoulos, 2016](#); [Koch, Nafziger and Nielsen, 2015](#)). One explanation may be that parents experience a present bias or lack self-control. As people often discount future outcomes relative to immediate outcomes, it is hard for parents to invest time and effort today for a return on their child’s human capital that might show up years later. Moreover, parents may lack self-control and perseverance in their busy everyday lives. As a result, many programs stop at the good intentions because of scarcity of time, energy, and persistence among participants ([Mullainathan and Shafir, 2013](#)). In a study of a school information system that provided information to parents, [Bergman \(2021\)](#) found that less than half of the families ever used the system—and that non-users were typically low-income families and families of low-achieving students. The same constraints may be true for interventions that provide resources to parents and try to encourage them to read with their children. Some have proposed approaches to mitigate these behavioral barriers. In a study of the use of a reading application, a treatment group was exposed to three different behavioral tools (i.e., a commitment device, text message reminders, and a social reward). The study suggests that behavioral tools were effective as they increased the usage of the reading application by 1 standard deviation ([Mayer et al., 2018](#)).

To examine the influence of such behavioral barriers, we randomly assigned participating schools to two versions of the READ program. By making small deviations from the basic READ program, we can test the effect of these modifications. We experimented with social rewards designed to shift preferences by increasing the utility of the current behavior. In the original READ program ([Andersen and Nielsen, 2016](#)), some teachers decided to use a logbook in which families

could note every time the child read (as previously described). The logbook endorsed child effort, not performance or results (not the speed or accuracy of the reading). When the children had read ten times, they could bring the logbook to their schoolteacher, and the class would receive a sticker. The class with the most stickers received a prize. In the original trial, use of the logbook was not randomized but selected by teachers. To test the additional effect of this social reward entailed by the logbook competition, we randomly assigned schools that accepted to receive READ to one of two conditions: READ Basic and READ Social Reward. Parents in the READ Social Reward group were provided with the same material as READ Basic, but also with the logbook. As in the original trial, when the children had read ten times, they could bring the logbooks to their schoolteacher, and the class would receive a sticker. One class—the class with most stickers at the school-level—received a prize: a gift card to a reading store worth 10,000 DKK (USD 1,500). This experiment enabled us to test the effect of the social rewards component.

Figure D.3 shows screenshots from the app, where parents could register every time they had read with their child.



(a) Screenshot (I) from READ app



(b) Screenshot (II) from READ app

Figure D.3: Smartphone app

Table D.3 shows that schools assigned to either READ Basic or READ Social Reward were balanced at baseline.

Table D.3: Baseline balance of READ Social Reward relative to READ Basic

	(1) Basic	(2) Social Reward	(3) 1-2	<i>p</i> -values
Student level				
Child is a boy	0.53	0.52	0.01	(0.35)
Child's age (2016)	8.08	8.10	-0.02	(0.09)
Child immigrant	0.12	0.12	-0.00	(0.84)
Mother compulsory education (2014)	0.15	0.15	0.00	(0.88)
Mother upper secondary education (2014)	0.05	0.05	0.00	(0.38)
Mother vocational education (2014)	0.32	0.33	-0.01	(0.64)
Mother short-cycle education (2014)	0.05	0.05	-0.01	(0.38)
Mother medium-cycle education (2014)	0.27	0.27	0.00	(0.98)
Mother long-cycle education (2014)	0.12	0.11	0.01	(0.48)
Father compulsory education (2014)	0.17	0.18	-0.01	(0.42)
Father upper secondary education (2014)	0.05	0.04	0.01	(0.28)
Father vocational education (2014)	0.43	0.44	-0.00	(0.86)
Father short-cycle education (2014)	0.08	0.08	-0.00	(0.90)
Father medium-cycle education (2014)	0.13	0.13	-0.00	(0.90)
Father long-cycle education (2014)	0.12	0.10	0.02	(0.27)
Missing test score (2017)	0.03	0.04	-0.01	(0.40)
School level				
School size ¹	45.00	44.62	0.38	(0.92)
Average test score (2016) ²	-0.08	-0.10	0.02	(0.80)
Students	3375	3391	6766	
Schools	75	76	151	

Notes: *p*-values based on standard errors clustered at the school level. ¹Number of students in second grade. ²Standardized using the mean and the standard deviation from the national sample in 2017.

Table D.4 shows that READ Social Reward did not change the number of app downloads compared to READ Basic.

Table D.4: Effect of READ Social Reward relative to READ Basic on the number of app downloads

	(1)	(2)
Social Reward	0.040 (0.037)	0.043 (0.036)
Mean of control	0.228	0.228
Observations	4804	4804
Schools (clusters)	110	110
Adjusted R-squared	0.002	0.032
Covariates	No	Yes

Notes: Standard errors clustered at the school level in parentheses. The full list of the included covariates is reported in Table 3.

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