Community-wide support for students to improve basic reading and math: Empirical evidence from Madagascar

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September 22, 2021

1. Motivations and focus of this study

- "Learning crisis" (World Bank, 2018; UNESCO, 2017; 2021)

- Parents often face challenges in supporting their children through schooling. "Unmotivated and unskilled teachers" is one of the principal causes of the learning crisis (World Bank 2018).

- Do information on student learning assessment sensitize and facilitate parents, teachers and community members to better support children's learning?

  - The information can update the knowledge of parents and motivates them to take action (Dizon-Ross, 2019; Barrera-Osorio et al., 2020). It can also be used for teachers to provide better teaching to students (Banerjee et al. 2017; de Hoyos 2019).

  - But in the information-only intervention, it depends upon individuals with different characteristics whether s/he takes action upon the information (Read and Atinc 2017).

1. Focus of this study

- Can information-based intervention be structured in a way that establish joint action among parents, teachers and community members to improve learning?

- This study investigates the impact of the package of interventions, called "*Paquet Minimum Axé sur la Qualité (*PMAQ*),*" that includes a structured process of information-sharing and discussions on student learning. The package of interventions are provided for school principals and members of school management committees (SMCs).

- The package also includes an effective pedagogical approach, "Teaching at the Right Level (TaRL)" as a pedagogical component on basic reading and math.

- Banerjee et al. (2008; 2010; 2017) demonstrate the effectiveness of TaRL. But the evidence on TaRL in Africa is still limited (e.g., Duflo et al. 2020).

1. Contribution to the literature

- Information-based intervention, including citizen-led assessment and school report card

    - Afridi et al. (2020), Andrabi et al. (2017), Banerjee et al. (2010), Lassibille et al. (2010), Muralidharan and Sundararaman (2010), Lieberman et al. (2014), Pandey et al. (2009)

- Interaction between parents and teachers (Islam 2019)

- Complementarities among the different inputs in a package of interventions (Kerwin and Thornton, 2020)

- External validity of PMAQ in other context (Maruyama and Kurosaki, 2021)

- Scaling up strategy of TaRL (Banerjee et al., 2017)

2. Poverty and low-quality of primary education in Madagascar

- Population: 27 million (2019), poverty rate: 77.4% (World Bank 2020), HDI ranking: 164/189 (2020) (UNDP)

- High gross enrolment ratio (primary): 134% (2019), but low survival rate to the last grade of primary: 31.6% (2018) (UNESCO)

- Low learning achievement in language and math (PASEC 2020).

- High percentage of locally-hired teachers (The ministry of education in Madagascar, 2017).

- SMC in Madagascar is called FEFFI. Parents, teachers, community members and the other actors related to local education can participate in FEFFI.

3. Contents of the package of interventions "PMAQ-TaRL"

Flow of package of interventions

First training (1 day) for school principal on Democratic establishment of SMC

Second training (2 days) for school principal and SMC permanent secretary on school action plan development and resource management

Third training (1) (3 days) & (2) (4 days) for representatives of teachers and community volunteers TaRL in basic reading, TaRL in math, and use of math workbook

Provision of math workbooks and simple learning materials for TaRL

Flow of activities by school and local community at the school-level

Democratic establishment of SMC

⬇

Teacher meeting & student assessment in basic reading and math

Organize community general assembly to present the result of student assessment, discuss school action plan, **"information-sharing and discussions on student learning"**

⬇

Organization of remedial activities

3. Design and timeline of the experiment

- Target region: Amoron'i Mania region
  1,002 public primary schools in the region.

- Method: RCT

- Treatment group: 70 public primary schools
  Control group: 70 public primary schools

- Target grades: Grade 3 through 5 students
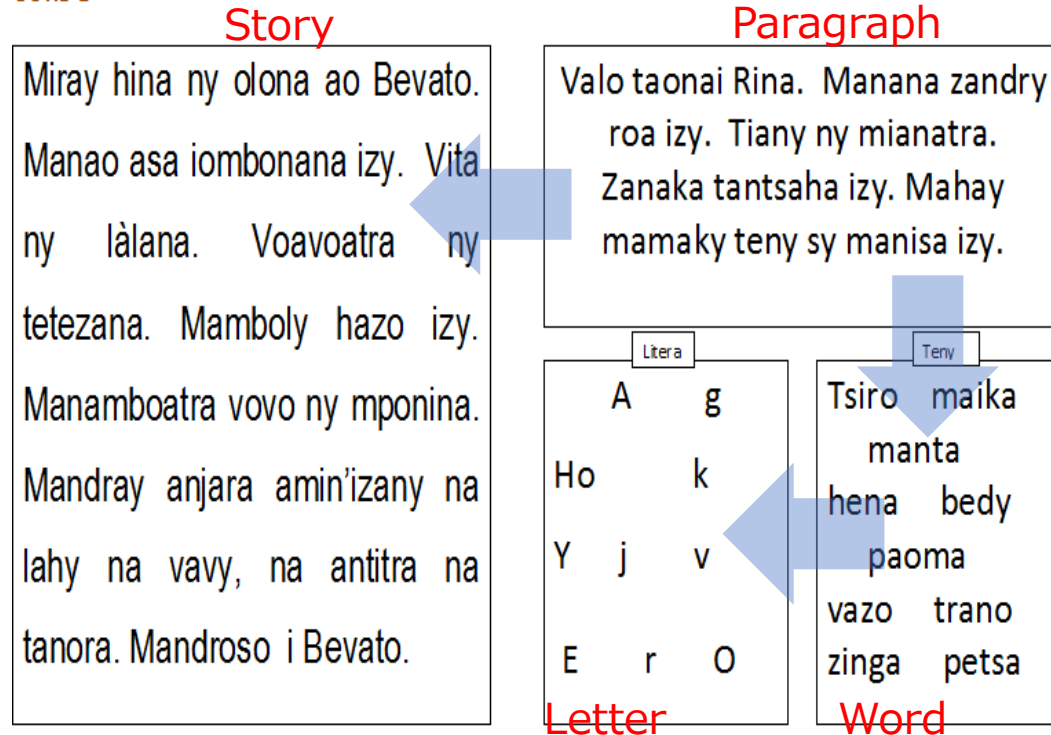 (Grade 2 also joined in remedial activities.)
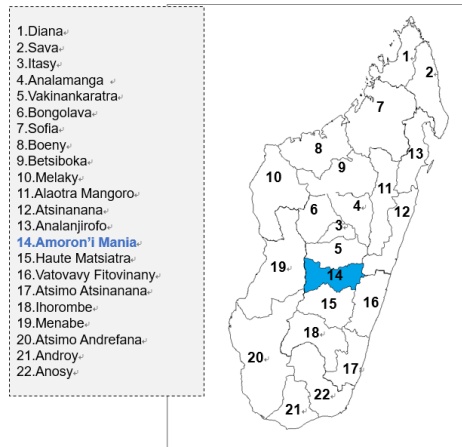
Timeline of events

2018 Sep.	•	Prepare tests and questionnaires
Nov.	•	Start of school year (2018-19)
	•	Baseline survey
Dec.	•	First training
2019 Jan.	•	Second training
Feb.	•	Third training (1)
March	•	Third training (2)
Jul.-Aug.	•	End-line survey
	•	End of school year (2018-19)
2020 Jan.	•	Supplementary survey to the end-line survey

1.Diana
2.Sava
3.Itasy
4.Analamanga
5.Vakinankaratra
6.Bongolava
7.Sofia
8.Boeny
9.Betsiboka
10.Melaky
11.Alaotra Mangoro
12.Atsinanana
13.Analanjirofo
14.Amoron'i Mania
15.Haute Matsiatra
16.Vatovavy Fitovinany
17.Atsimo Atsinanana
18.Ihorombe
19.Menabe
20.Atsimo Andrefana
21.Androy
22.Anosy

1. Motivations and focus of this study
2. Context and Background
3. Experimentation design
4. Results
5. Discussions and conclusions
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3. Assessment tool of student learning in basic reading and math

Figure 2. Example of assessment tool of basic reading (ASER tool) in Malgache

OUTIL 1

Story

Miray hina ny olona ao Bevato. Manao asa iombonana izy. Vita ny làlana. Voavoatra ny tetezana. Mamboly hazo izy. Manamboatra vovo ny mponina. Mandray anjara amin'izany na lahy na vavy, na antitra na tanora. Mandroso i Bevato.

Paragraph

Valo taonai Rina. Manana zandry roa izy. Tiany ny mianatra. Zanaka tantsaha izy. Mahay mamaky teny sy manisa izy.

Litera

A	g
Ho	k
Y j	v
E r	O

Letter

Teny

Tsiro maika
manta
hena bedy
paoma
vazo trano
zinga petsa

Word

Note: ASER (Annual Statistics of Educational Record) tool was originally developed by Indian NGO Pratham. JICA Ecole pour tous project applied the tool to the local language in Madagascar.

- Assessment of basic reading
  - One-on-one interview
  - Evaluate by five levels, (i) beginner; (ii) letter; (iii) word; (iv) paragraph; and (v) story level.

- Assessment of math
  - Written test
  - 40 items (numbers and four basic operations) (Q1 to 40)
  - 4 items (problem posed in text) (Q41 to 44)

3. Balance check of the treatment and control groups

Figure 3-1. Stacked chart of basic reading level at the baseline survey (grade 3)
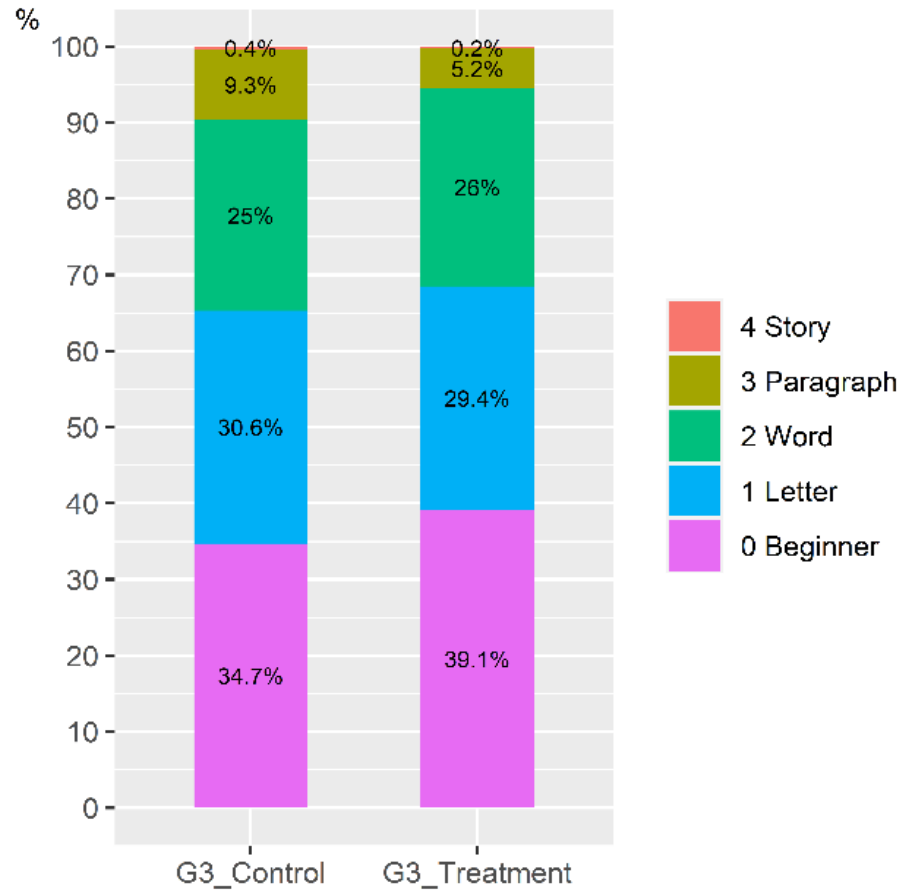
Number of students: 3,510
Source: Baseline survey

Table 1. Balance check of student characteristics

	(1) Treatment	(2) Control	(3) (1)-(2)
Grade 3:			
Age	9.653	9.874	-0.221**
Female students	48.5%	46.4%	2.2%
Repeated last academic year	30.6%	29.8%	0.7%
Basic reading level: 1 to 5	1.977	2.103	-0.125
Math test scores (points): 0 to 44	12.33	13.59	-1.253
Math test scores (standardized)	-0.154	0.000	-0.154
Number of clusters	70	70	
Number of observations	1,895	1,615	
Grade 4:			
Age	11.09	11.04	0.051
Female students	48.5%	51.0%	-2.5%
Repeated last academic year	28.4%	27.4%	1.0%
Basic reading level: 1 to 5	2.755	2.849	-0.094
Math test scores (points): 0 to 44	19.96	22.07	-2.110**
Math test scores (standardized)	-0.252	-0.000	-0.252**
Number of clusters	67	68	
Number of observations	1,488	1,199	
Grade 5:			
Age	12.01	12.09	-0.078*
Female students	51.3%	52.9%	-1.6%
Repeated last academic year	31.3%	27.4%	3.9%
Basic reading level: 1 to 5	3.464	3.504	-0.039
Math test scores (points): 0 to 44	30.14	31.19	-1.048
Math test scores (standardized)	-0.140	-0.000	-0.140
Number of clusters	62	67	
Number of observations	1,174	1,086	

Notes: Column 3 reports the difference between the treatment and control groups and the result of the test for the difference in means between the two groups. The test controls for strata fixed effects constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors clustered at the school level are used. ** $p<0.05$, * $p<0.1$.

1. Motivations and focus of this study
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4. Estimation strategy

(1) The impacts on voluntarily mobilized resources

$$R_s=\theta+\lambda\text{Treatment}_s+\tau R_s^{\text{base}}+S_s\rho_S+D_s\rho_D+\upsilon_s\ (a)$$

- R_s is the total monetary value of voluntarily mobilized resources from the community.
- Robust standard errors are used.

(2) The impacts on student learning

$$Y_{is}=\alpha+\delta\text{Treatment}_s+\gamma Y_{is}^{\text{base}}+C_{is}\beta_C+S_s\beta_S+D_s\beta_D+\varepsilon_{is}\ (b)$$

$$Y_{is}=\alpha+(\delta_1+\delta_2 Y_{is}^{\text{base}})\,\text{Treatment}_s+\gamma Y_{is}^{\text{base}}+C_{is}\beta_C+S_s\beta_S+D_s\beta_D+\varepsilon_{is}\ (c)$$

- Y_{is} takes either the basic reading proficiency level or the math test standardized scores of student *i*. C_{is} is a vector of characteristics of student *i* at school *s*, such as age, sex.
- S_s is a vector of characteristics of school *s*, such as the number of students, school infrastructure, school principal in charge of class, and the ratio of regular teacher.
- Robust standard errors clustered at the school level are used.

4-1. Organization of supplementary classes (remedial activities in basic reading and math)

Table 3-1. Percentage of schools that organized supplementary classes

	2017-18 school year			2018-19 school year		
	T	C	T-C	T	C	T-C
For Grade 3	5.71%	4.29%	1.43%	100%	1.42%	98.6%***
For Grade 4	9.09%	13.2%	-4.14%	100%	10.3%	89.7%***
For Grade 5	63.9%	68.2%	-4.25%	100%	54.5%	45.5%***

Note: (1) T: Treatment group; C: Control group. Number of schools in each group is 70. *** p<0.01. (2) Column T-C reports the difference between the treatment and control groups and the result of the test for the difference in means between the two groups. The test controls for strata fixed effects constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors are used.

4-1. Mobilization of community resources for joint actions in education

Table 3-2. Impacts of PMAQ-TaRL on the resource mobilization for education

	(1)-1 Total amount of voluntary resource (1,000 Ar.)	(1)-2 Total amount of voluntary resource (per student) (1000 Ar.)
Treatment	754.1***	6.845***
	(182.7)	(1.438)
Total amount of voluntary mobilized resources last academic year	0.731	0.003
	(0.500)	(0.003)
Total amount of external mobilized resources last academic year	0.298	0.001
	(0.289)	(0.002)
Average value in the control group	308.4	2.755
Covariates	Yes	Yes
Strata FE	Yes	Yes
Num. obs.	140	140

Note: *** $p<0.01$, ** $p<0.05$.
Strata fixed effects are constructed by the stratification variables in the random assignment (district, urban status, and the size of school. Robust standard errors are used.

cf.
- Unit cost of primary education (2014): 60,958 Ar. (Source: Ministry of education in Madagascar)

- Household expenditure for education (primary) (2012-13): 47,000 Ar. (Source: Ministry of education in Madagascar)

4-2. Impact of PMAQ-TaRL on learning outcomes

Table 4. Impacts of PMAQ-TaRL on basic reading (grade 3)

	(1) Reading level	(2) Reading level	(3) Beginner level	(4) Above paragraph level	(5) Reading level
Grade 3:					
Treatment	0.597***	0.635***	-0.090***	0.255***	0.639***
	(0.069)	(0.062)	(0.019)	(0.034)	(0.061)
Treatment × Reading level at baseline					0.083
					(0.063)
Number of clusters	140	140	140	140	140
Number of observations	2868	2868	2868	2868	2868
Covariates	No	Yes	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes

Notes: All models control for the outcome variable at the baseline survey. Strata fixed effects are constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors clustered at the school level are used. *** $p<0.01$.
(a) Reading level in the interaction term is subtracted by the average in the control group at the baseline survey.

4-2. Impact of PMAQ-TaRL on learning outcomes

Table 5. Impacts of PMAQ-TaRL on math (grade 3)

	(1) Standardized total scores	(2) Standardized total scores	(3) Standardized scores of knowing skill (No. 1 to 40)	(4) Standardized scores of applying skill (No. 41 to 44)	(5) Standardized total scores
Grade 3:					
Treatment	0.525***	0.560***	0.500***	0.920***	0.556***
	(0.068)	(0.059)	(0.059)	(0.083)	(0.058)
Treatment ×					-0.113**
Total scores at baseline					(0.047)
Number of clusters	140	140	140	140	140
Number of observations	2868	2868	2868	2868	2868
Covariates	No	Yes	Yes	Yes	Yes
Strata FE	Yes	Yes	Yes	Yes	Yes

Notes: All variables on math test scores are standardized by the mean and the standard deviations of the control group at each round of survey. All models control for the outcome variable at the baseline survey. Strata fixed effects are constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors clustered at the school level are used. *** p<0.01.

4-3. Impacts of PMAQ-TaRL

Table 6. Impacts of PMAQ-TaRL on the dropout rate, repetition rate and passing rate of certificate exam (CEPE) in the 2018-19 school year (the school-level)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dropout rate			Repetition rate			Ratio of passing CEPE	Ratio of moving to G6
	Grade 3	Grade 4	Grade5	Grade 3	Grade 4	Grade5		
Without covariates:								
Treatment	-0.023*	-0.045**	-0.025	0.025	0.032	-0.092*	0.111**	0.118**
	(0.013)	(0.022)	(0.025)	(0.027)	(0.028)	(0.051)	(0.052)	(0.051)
With covariates:								
Treatment	-0.025*	-0.044*	-0.017	0.022	0.042	-0.102**	0.111**	0.111**
	(0.014)	(0.024)	(0.025)	(0.028)	(0.029)	(0.051)	(0.050)	(0.051)
Number of observations	140	135	128	140	135	128	127	127

Notes: Covariates include total number of students, have a multi grade class in the analyzed grade or not, number of classrooms, school facilities listed in Table 1-2 except for electricity, school principal in charge of class, and ratio of regular teachers. Strata fixed effects are constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors are used. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

5. Discussions

- In the past, under School-Based Management reform, school management body (e.g., SMC) was introduced in developing countries (Bruns et al. 2011). In the logic of reform, parents and community members were supposed to monitor and voice for school. In response to the demand, school was supposed to improve the quality of education.

- PMAQ-TaRL utilizes SMC in a different way that parents, teachers and community members collaborate with each other to improve learning. In the model, SMC executive members are key facilitators to lead school action plan development.

5. Conclusions

- The package of interventions, PMAQ-TaRL, mobilized local stakeholders to organize supplementary classes of remedial activities in basic reading and math around for 3 to 4 months. Students from grades 3 through 5 improved basic reading and math.

- Furthermore, the package of interventions led to the decrease in student dropouts (grade 3 and 4) and the increase passing rate of certificate exam (grade 5).

- The past research on TaRL presented "learning camp model" and "government partnership model." (Banerjee et al. 2017) This study proposed another strategy to scale up TaRL through joint actions among parents, teachers and community members, "community collaboration model."

Appendix

Balance check of the treatment and control groups

Table 2. Balance check of school and SMC characteristics

	(1) Treatment	(2) Control	(3) (1)-(2)
School:			
Total number of students	128.0	114.7	13.26
Ratio of female students per male students	0.998	0.946	0.052
Ratio of school with a multi-grade class: Grade 3	22.9%	15.7%	7.1%
Grade 4	46.3%	60.3%	-14.0%**
Grade 5	43.5%	56.7%	-13.2%*
Ratio of students dropped out last academic year: Grade 3	5.8%	7.1%	-1.3%
Grade 4	6.0%	7.2%	-1.1%
Grade 5	13.4%	13.9%	-0.5%
Ratio of repeated students last academic year: Grade 3	33.4%	33.2%	0.2%
Grade 4	31.7%	29.2%	2.5%
Grade 5	39.9%	37.2%	2.7%
Ratio of students passing certificate exam in last academic year	47.6%	49.7%	-2.1%
Ratio of students moving to 6th last academic year	48.0%	49.4%	-1.4%
School Principal: Experiences (years)	10.64	8.500	2.143
School Principal: No certificate	51.4%	50.0%	1.4%
School Principal: In charge of class	97.1%	92.9%	4.3%
School Number of teachers (incl. head master)	4.486	4.171	0.314
Average number of students per teacher	28.41	28.50	-0.095
Ratio of regular teachers	13.3%	14.0%	-0.7%
Ratio of contract teachers	19.0%	20.9%	-1.8%
Ratio of non-regular teachers (not including contract teachers) (salary is paid from the subvention of school.)	34.8%	42.0%	-7.2%*
Ratio of non-regular teachers (not including contract teachers) (salary is not paid from the subvention of school.)	32.8%	23.1%	9.7%**
Ratio of teachers without certificate	77.7%	73.5%	4.3%
Number of classrooms	5.271	5.071	0.200
School facility: electricity	0.0%	0.0%	0.0%
School facility: drinking water	8.6%	10.0%	-1.4%
School facility: toilet	82.9%	82.9%	0.0%
School facility: library	1.4%	1.4%	0.0%
School facility: kitchen	8.6%	10.0%	-1.4%

We observe some differences in the percentage of multi-grade classes and the source and modality of salary payment for non-regular teachers. But the differences in school characteristics between the two groups are not systematic.

Balance check of the treatment and control groups

Table 2. Balance check of school and SMC characteristics (continued)

	(1) Treatment	(2) Control	(3) (1)-(2)
FEFFI:			
Years of existences of FEFFI	1.543	1.757	-0.214*
President's experiences (years)	1.457	1.571	-0.114
Have the action plan (PEC)	5.7%	5.7%	0.0%
Sharing of test result of pupils at general assembly	5.7%	7.1%	-1.4%
Mobilize voluntary resource for any activities	31.4%	34.3%	-2.9%
Total amount of used voluntary resource (1000MGA)	138.2	137.3	0.952
Utilize Caisse Ecole for any activities	61.4%	68.6%	-7.1%
Utilize SAE for any activities	64.3%	61.4%	2.9%
Total amount of used external resource (1000MGA)	866.5	754.8	111.7*

Notes: (1) Column 3 reports the difference between the treatment and control groups and the result of the test for the difference in means between the two groups. The test controls for strata fixed effects constructed by the stratification variables in the random assignment (district, urban status, and the size of school). Robust standard errors are used. ** $p<0.05$, * $p<0.1$. (2) CEPE is the certificate exam

We observe some differences in characteristics of SMC (the years of existence of FEFFI, and the total amount of external resources last academic year). But the differences between the two groups are not also systematic.

Student attritions

	Treatment group		Control group	
	N. of students	Change (Percentage in the original sample)	N. of students	Change (Percentage in the original sample)
Grade 3 : Baseline	1,893		1,615	
End-line	1,560	-333 (17.6%)	1,306	-309 (19.1%)
Grade 4: Baseline	1,488		1,199	
End-line	1,218	-270 (18.1%)	981	-218 (18.2%)
Grade 5: Baseline	1,174		1,086	
End-line	1,031	-143 (12.2%)	937	-149 (13.7%)

- Student attrition occurred at similar rates for the two groups.

- We regressed the attrition dummy on the treatment assignment and student characteristics for each grade. The coefficients of the treatment assignment are close to zero and not statistically significant.

Organization of supplementary classes
(remedial activities in basic reading and math)

- On average, 40.4 hours of supplementary class in basic reading and 38.4 hours in math were organized in the treatment group.

- Average daily attendance rates was 89.3 percent in basic reading, and 84 percent in math.

- In the treatment group, in total, 293 teachers (92.2 percent) were involved in supplementary classes, and 196 community volunteers supported the remedial activities.

Note: (1) Data source of volume and attendance rate of supplementary classes is the attendance check record per class at the treatment schools. While there were 374 classes of remedial activities in basic reading in the treatment group in total, the attendance records were available at 92.2 percent of the classes. (2) Average daily attendance rate is calculated by the following three steps, (a) calculate average attendance rate per class per 10 days, (b) calculate average attendance rate per class from (a), (c) calculate average attendance rate per school from (b). (3) Since SMC organized remedial activities for grade 2 through 5 students, the data includes the attendance of grade 2 students.

Figure 4: Academic records of community volunteers (treatment group)

Segment	Percent
Upper Secondary (BAC)	33.2%
Upper Secondary	24%
Lower Secondary	22.4%
Lower Secondary (BEPC)	11.7%
Primary (CEPE)	3.06%
University	3.06%
Primary	2.55%
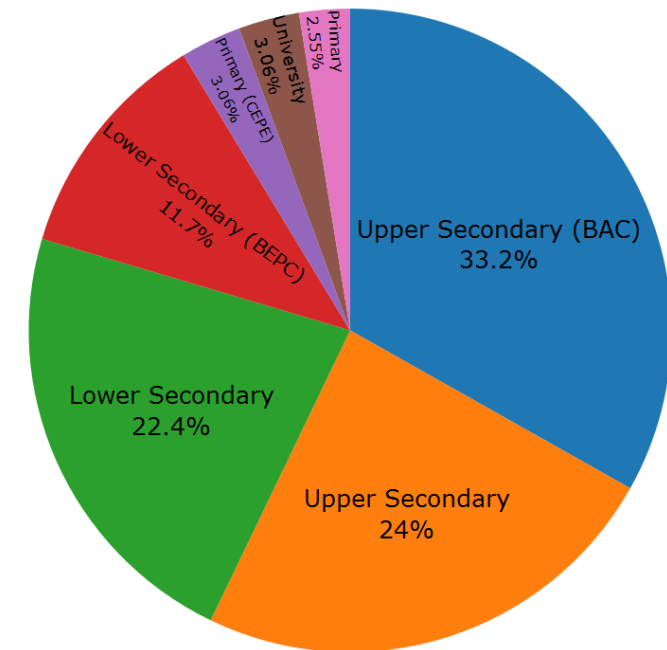
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