



# WORKING PAPER

## The Impact of Continuous Professional Development (CPD) for School Leaders on Student Performance

**2022**

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## Executive summary

Professional development training programmes in school leadership often aim at improving leadership skills of the existing and aspiring school leaders and play a pivotal role in improving school quality. Since 2014, with support of VVOB – education for development, Rwanda Basic Education Board (REB) and the University of Rwanda – College of Education (URCE) have developed and delivered a Continuous Professional Development (CPD) Training Programme on Effective School Leadership for school head teachers (HT) and deputy head teachers (DHT) in the primary and general secondary in Rwanda. This programme's theory of change assumes that CPD of school leaders leads to improved professional development of teachers and a learning culture in schools that eventually leads to improved learning outcomes for students. Approaching the end of the current implementation of the programme and the learning cycle in 2021, all involved partners together with Maastricht University intend to answer one question: What is the impact of the CPD Diploma Programme in Effective School Leadership on students' academic performance in the schools where school leaders participated in the programme?

This study applies a quasi-experimental research design, using a difference-in-differences (DiD) framework. Schools with head teachers or deputy head teachers (HT/DHT) that have completed the CPD Training Programme on Effective School Leadership (intervention group) are compared with schools with HT/DHT that have not completed the CPD Training Programme (control group). In the DiD analysis, we furthermore compare the year of the treatment with the year immediately after the treatment, and the interaction between year and treatment. The intervention group are schools with HTs and/or DHTs that have been trained in the cohort of 2015/16 (C0-cohort) or 2018/19 (C1-cohort), who successfully completed the CPD Training Programme. In intervention group C0, school leaders were selected and asked to participate based on their previous performance as a school leader, intervention group C1 was allocated randomly. For power reasons, we combine the two treated cohorts in the analyses, where we compare the year of treatment (2015/16 for C0 and 2018/19 for C1) with the year thereafter. However, to get an idea whether one of the two cohorts might be driving these results, we also run the analyses for the two cohorts separately. The study matches participation data of (D)HTs for the CPD Programme with student performance and school-level data. It looks at student examination grades in English, Kinyarwanda, and Mathematics, and passing rates, in the final year of primary education (P6) and halfway secondary education (S3). The regression analyses include several control variables at the school and (D)HT level, such as the number of years of experience of the (D)HT and school category (government-aided, public, private). The analyses are performed on a total of around 2518 observations for the P6 analyses and around 1399 observations for the S3 analyses.

The results show a positive and significant effect for English for students in treated schools in the year immediately after the intervention, both for P6 and for S3. No overall effect was found for the other subjects. However, interaction analyses with school leader position show that both in P6 and S3 the results in English are driven by DHT being trained. For Kinyarwanda we do find a positive effect for when the HT is trained, but not for DHT. For Math the results for HT and DHT separately are not consistent, and for passing rates no differential effects were found. For English in P6 we find that the treatment is particularly effective in private schools, in comparison with government aided schools. The robustness analyses in which we separate the cohorts suggest that the above described results are driven by the C0-cohort. Based on the separate analyses it seems that the found overall effect is driven by the C0-cohort, which was selected based on school leader performance, including their English, whereas the C1-cohort was selected completely randomly. It is possible that the effect is indirectly due to other characteristics of the participating school leaders/schools, characteristics that also make it a high-quality school, or that motivation of the participants plays a role here.

Another potential reason for not finding effects for other subjects than English and for the C1-cohort is that it might take more time for the effect for particularly the C1-cohort to become large enough that

it is detectable, due to the given the unequal division between treated and control schools. We conclude that the CPD-intervention was effective to increase English performance, and when HT are trained also for Kinyarwanda, for both P6 and S3. This implies that the intervention was partly effective, and that the effects are very consistent between P6 and S3. However, we need to further investigate the differences between effect in subject and between position of the school leader. In quantitative research, this could be done by including later trained cohorts and collecting data on later years, for more robust results and a better power.

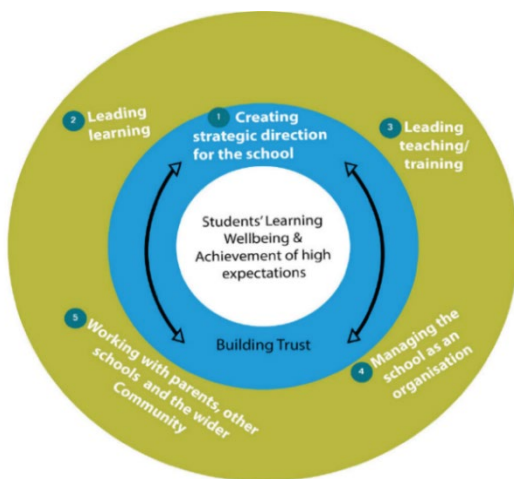
Qualitative research could be used to interview HT and DHT to find out whether participating in the training program has different effect on their everyday work and could involve observing classrooms of the different subjects, and interviewing teachers to find out how it can be explained that an effect is found for English (and for Kinyarwanda for HT), but not for the other subjects or for the passing rate. In this research one would like to know what school leaders did different after the training, who did they reached with that different behavior, how that affected teachers, what they did different in class and how that may have affected students' behavior and/or learning opportunities/learning quality.



## I. Introduction and background

Over the last decade, several studies have proven the importance of school leaders in improving the quality of education at school level. Using different leadership practices, an effective school leader is asked to set up an enabling environment for effective teaching and learning for the school community. Leaver et al. (2019) suggested that, in Latin America, school leadership impacts student outcomes through improving teacher selection, teacher incentives, and parental engagement. Bloom et al. (2015) in their study in 8 countries and found that while the management practiced may defer across countries; the management quality is positively correlated with learning outcomes. Furthermore, Grissom et al. (2021) argue that school leaders will impact learners more effectively than a single teacher. Clarifying that the school leader will impact learners indirectly through teachers by setting up the right environment for teaching and learning and directly by exposing learners to strong teaching. Moreover, continuous capacity development programmes further improve the capacity of school leaders to incorporate in their school's leadership dimensions. Muhammad et al., (2011) in their study in Pakistan showed that school management trainings enable school leaders with school management skills which equip them with capacities to effectively manage schools and consciously commit towards motivation and satisfaction of their teachers as well as students. In addition, Carneiro et al. (2020) in a randomized study in Senegal found evidence that schools that organize trainings for their school leaders and teachers improved student outcomes (Global School Leaders, 2020).

Figure 1: National School Leadership Standards



In Rwanda, one of the strategic priorities of the Ministry of Education (MINEDUC) is to have an effective school leader in every Rwandan school (Education Sector Strategic Plan (ESSP) 2018/2024 outcome 9.1). The ESSP acknowledges that the main challenge remains to transform the role of school leaders from a largely administrative role to becoming true leaders of their schools with more focus on leading teaching and learning in the school. The ESSP recognizes the need for training, capacity building and support, and refers to the role of effective professional learning communities and positive

learning environments in this (VVOB, 2019). In this line, the Rwanda Basic Education Board (REB) through its School Leadership and Management Unit (SLMU) and in collaboration with Development Partners, schools and local education leaders developed five professional standards for effective school leaders. The five standards being (see Figure 1): creating a strategic direction for the school; leading learning; leading teaching; managing the school as an organization; and working with parents and the wider community (Rwanda Basic Education Board, 2020).

Since 2014, with support of VVOB – education for development, REB and the University of Rwanda – College of Education (URCE) have developed and delivered a Continuous Professional Development (CPD) Training Programme on Effective School Leadership (ESL) for school head teachers (HT) and deputy head teachers (DHT) in the primary and general secondary in Rwanda. The programme was first offered by UR-CE as a Diploma Programme in 2016 HT in primary schools (i.e., 1 head teacher per sector was enrolled). Based on monitoring, evaluation and research evidence, the programme was further revised and since 2018, the programme is offered to HT and DHT in 17 districts. In 2019, District Directors of Education (DDEs) and District Education Officers (DEOs) from 17 districts were included also in the programme. Over the course of more than seven years and in 4 cohorts, 2,092 school leaders

(HTs, DHTs and district officials) have participated in this Training Programme and 1,431 have already completed the programme (see Table 1 below). Additional CPD support has been provided to these HT in Professional Learning Communities (PLC) that are facilitated by trained Sector Education Inspectors (SEI) at the level of the sectors. Next to CPDs for headteachers, Training Programmes for other key actors in schools were developed and implemented as well: school-based mentors (SBM) and STEM school subject leaders (STEM SSL) are trained on Educational Mentorship and Coaching and are expected to initiate school-based Communities of Practice (CoP) to engage all teachers in school-based CPD.

*Table 1: Number of school leaders (HT and DHT) participated in CPD DESL, by position*

Cohorts	HTs	DHTs	District Officials	Total	% Passed	Completion date
ESL cohort 0	416			416	95.43%	2015/2016
ESL cohort 1	328	238		566	91.34%	2018/2019
ESL cohort 2	268	162	19	449	65.05%	August 2020
ESL cohort 3	227	176		403	Ongoing	December 2021
ESL cohort 4	125	16	22	163	Ongoing	December 2021
<b>Total</b>	<b>1,364</b>	<b>673</b>	<b>50</b>	<b>1,997</b>		

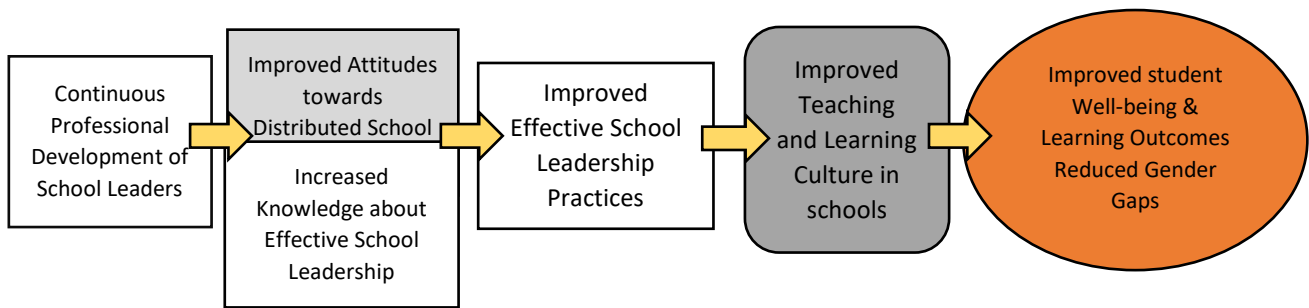
Note:

- High fail rate in Cohort 2 due to COVID-19 effects and shift to online learning
- Cohort 3 contains some trainees from 4 non-intervention districts (Rutsiro, Gakenke, Nyamagabe and Bugesera) and are used as control group for a Cost-Effectiveness study.
- Cohort 4 contains also districts officials from 13 non-intervention districts

The purpose of the diploma programme for ESL is for HT and DHT to grow in their role as school leader, to develop their competences, to improve the overall school environment and to lead their teachers to improve teaching quality, with the ultimate goal to improve students learning, well-being and achievements. Effective school leaders motivate teachers to invest in their professional development and encourage exchange and learning from each other. The programme, consisting of 40 credits offered in four modules is a one-year long programme, that originally was set up to have 18 contact days (of which 16 training days in blocks of 2 days, and 2 examination days). In 2019 the programme was offered as a blended programme, with 14 training days face-to-face (f2f) and 2 days through online/distance learning. These modules are based on the five professional standards (see Figure 1) for effective school leadership, and they consist of: (1) Overview of school leadership and working with parents and the wider community; (2) Creating strategic direction for the school; (3) Managing the school as an organisation; and (4) Leading learning & leading teaching. Furthermore, there are 5 crosscutting themes including school improvement planning, inclusive education, and gender, monitoring and evaluation, ICT integration and school collaboration.

In line with the interventions' Theory of Change, as depicted in Figure 2 below, the VVOB/REB/UR – CE CPD intervention logic assumes a cascade takes place from CPD of School Leaders (HTs and DHTs) to changes in the short term in their beliefs, attitudes and school leadership practices (behaviour), which influences the teacher professional development climate and learning culture in schools. In the longer term, in line with the conceptualization by Desimone (2009), these changes would have an impact on students, especially on their wellbeing and their learning outcomes, and equity gaps such as gender would be reduced or eliminated (Desimone, 2009).

Figure 2: Theory of Change on impact of CPD on school leaders, schools, and students



In line with this intervention logic and theory of change a monitoring and evaluation (M&E) system has been developed to monitor and evaluate the effects and impact of the CPDs, i.e., the CPD Training Programme on Effective School Leadership, at the level of the trainees and at the level of the schools. Following the Kirkpatrick training evaluation revised model Kirkpatrick & Kirkpatrick, (2016), data is collected regarding the reaction of trainees (satisfaction), their learning and behaviour change. At the level of the schools, it is measured whether these training have an impact on the teaching and learning culture in schools. Various internal and external evaluation and impact studies are showing positive effects and impacts at all these levels. VVOBs internal evaluations concluded that participants in the training programmes were satisfied with the training programmes, that they learned a lot and they changed their behaviour when they are back on the job. In terms of changes at the learning level, there were consistent improvements in competences and confidence for all beneficiary groups, including for trained HTs and DHTs. The main improvements observed being that there are more favourable attitudes about shared and transformational leadership among School Leaders (VVOB, 2020). Furthermore, an external qualitative midline evaluation of the CPD Programmes, carried out by Three Stones International, showed that there is a synergetic effect at schools where key staff are trained. The same evaluation study observed that there are changes in leadership style, quality of CPD activities offered to teachers and increased communication and collaboration between school leaders and teachers. The study confirms that changes in school leadership have increased collaboration between teachers, creating an environment of mutual respect that motivates teachers to improve the quality of teaching (VVOB & Three Stones International, 2020).

Approaching the end of the current implementation and learning cycle in 2021, all involved partners, (i.e., REB, URCE and VVOB), now plan to investigate the impact of the CPDs on Effective School Leadership at the level of the schools and the students in the schools. This study aims to match participation and course completion data of HTs and DHTs for the CPD Training Programme on Effective School Leadership with school-level data, as well as with data at the level of students in the targeted schools, such as examination, pass, repetition, and drop-out data of these students. This study primarily intends to answer one research questions: ***What is the impact of the CPD Diploma Programme in Effective School Leadership on students' academic performance in the schools where school leaders participated in the programme?***



## II. Literature review

This section provides further evidence on the importance of school leadership in improving the quality of education and how CPD programmes promote effective school leadership at school level.

### ***School leadership and quality of education***

A school's success is largely accountable to school leaders' proper leadership and management skills. School leaders for example hold the key for motivating teachers, improving the school's capacity and building a favourable climate within schools - all of which contribute to improving educational quality (Pont et al., 2008). Often these dimensions are inspired by different leadership approaches and styles such as instructional leadership, transformational leadership, distributed leadership and situational leadership (Daniëls et al., 2019). Instructional leadership mostly focuses on setting school goals, curriculum implementation, inclusivity, quality of instruction and school environment; transformational leadership aims at promoting intrinsic motivation among the school members (particularly teachers); distributed leadership focuses on sharing responsibilities among teachers, parents, and students instead of concentrating it only within the headteacher. Situational leadership refers to the ability of the school leader to adopt to a particular leadership pattern, depending on the context or problem experienced by the school (VVOB, 2019).

With respect to distributed leadership, Chang, (2011) conducted a study in the context of Taiwanese elementary schools using structural equation modelling (SEM) and demonstrated that if school leaders practice distributed leadership, it is likely to enhance teachers' optimism which in turn will enhance students' performances in schools. Distributed leadership does not undermine the traditional role and responsibilities of the school leader; rather it focuses on efficient distribution of tasks across all the school members, thereby increasing their involvement within their profession. Thus, distributed leadership can enhance teachers' optimism and teaching quality which further translates into improved students' performances. Furthermore, Heck & Hallinger (2009) used multilevel latent change analysis to demonstrate how distributed leadership can enhance the elementary schools' academic capacity in the western states of the US. In fact, a school's academic capacity (characterized by increased availability of the opportunities that improve teaching and learning outcomes within schools) and ability of school leaders to practice strong leadership is often seen as mutually enforcing. This increased capacity resulting from the distributed leadership positively impact students' outcome, as demonstrated by increased improvement in the students' maths score over time. The indirect impact of school leaders' efficient leadership practices (often in distributed pattern) on improving students' outcome is also supported by a qualitative analysis by Penlington et al. (2008) based on the primary and secondary schools involved in "The Impact of School Leadership on Pupil Outcomes" project in England.

With respect to specific skills that impact the quality of education, Robinson et al. (2008) used a meta-analysis of 11 published papers to study the 5 leadership dimensions and their relative impacts on student outcomes. The 5 leadership dimensions including 1-Establishing Goals and Expectations, 2-Strategic Resourcing, 3-Planning, Coordinating and Evaluating Teaching and the Curriculum, 4-Promoting and Participating in Teacher Learning and Development and 5- Ensuring an Orderly and Supportive Environment. Their results showed that moderate to large impacts on learning outcomes were observed where the school leaders are more involved and participate in the 3<sup>rd</sup> and 4<sup>th</sup> dimensions, which focus on the schools' core business of teaching and learning. Salfi (2011) using a mixed-method approach in the context of Pakistan - Sindh province; demonstrated that often the headteachers from the successful schools are observed to exhibit efficient leadership and management

skills. Often, they share a common vision, trust, and involve stakeholders in decision making. They maintain a good working environment and practices distributing leadership i.e., sharing the school responsibilities among other school members. Mbiti et al., (2019) in their randomized study on school grants and teachers' incentives in Tanzania found that schools with stronger leadership were more likely to exploit effectively resources required to impact student learning. Furthermore, with respect to impact of leadership on student performance; Bloom et al. (2015) studied school leaders in eight countries and found that one point increase in school leaders scoring on school management practices was correlated with a 10% increase in student performance. Crawford (2017) in his study in Uganda on the management quality of schools in individual student test scores found highlighted that a variation in management is associated with a 0.06 variation in the test scores. Leaver et al. (2019) further explore this in a study in 65 countries participating in the Programme for International Student Assessment (PISA) and showed that among school leaders scoring from the bottom 25% to top 25% in their quality management; for schools with leaders in the top 25% student learning outcomes were equivalent to an additional three months of schooling for every year.

### ***Promotion of effective school leadership through CPD programmes***

Professional leadership training programmes often aim at improving leadership skills of the existing and aspiring school leaders and play a pivotal role in improving school quality. While not many studies investigating the direct link between training programmes on school leadership and learning outcome were found; there are several studies that support that the training programmes help the school leaders improve their leadership skills, often in a significant way.

To assess the effectiveness of a leadership programme on headteachers' leadership skills, Bush et al. (2006) evaluated the effectiveness of the 'New Visions: Induction to Headship' programme which was conducted by the National College for School Leadership in England. Based on the participating headteachers' responses in an interview, they found that over 80 percent of the cohorts were satisfied with the training programme in the sense that they got opportunities to work with other school leaders, solve problems with others and received support from facilitators and consultant heads; about half of the participants in the survey reported that the programme helped them build leadership skills. The headteachers' positive changes with respect to clearer vision and confidence were discernible among the teachers and governing bodies even though they were less aware of the training programme.

Literature suggests that most of the school leaders in Western African countries often lacked proper training and often relied on the existing school leaders for their training purposes. In this context, Bush & Glover (2016) analysing the existing literature, suggested that often this kind of training based on the 'apprenticeship model' is bureaucratic, hierarchic and managerial in nature and often deprives the school leaders from acquiring important leadership skills (such as instructional leadership) that is pivotal for greater student achievements. They emphasized the need for formal training programmes with extensive focus of leadership dimensions that can facilitate better educational outcomes. All these factors necessitated the introduction of formal training programmes in Africa that would focus both on the management and leadership dimensions. There are various studies which provide insights in the formal training programmes which were recently provided in Africa to train the school leaders.

Bush et al. (2011) had presented a qualitative assessment of the Advanced Certificate in Education: School Leadership (ACE) programme which was first introduced in six provinces of South Africa in 2007-09. ACE was provided by the universities, jointly with the national Department of Education and National Management and Leadership Committee (NMLC), mostly targeting to train the already appointed school principals and the aspiring ones. The programme came into implementation once the former South African Department of Education designed a new threshold for appointing school

principals for improving educational standards. The results were mixed. The respondents who participated in the programme often expressed mixed responses regarding the course content of the material: while some found the course materials useful, others found it too elaborate and detailed and often not focusing on the main leadership aspects and less contextual considering the main problems of the South African schools. The contact sessions between the mentors and participants were often used for the content delivery of the course rather than interactive sessions. It was often also costly to provide one-to-one mentoring and the mentors were often not well-trained and professional, as was needed for effective training of the participants. Furthermore, the participants often had to devote a huge amount of time in completing assignments for the training programme instead of devoting the time for school management. This might have a detrimental influence on the students' performance, because, as Horng et al. (2010) have confirmed in one of their empirical studies, when a principal devotes more time to organizational management, it is likely to result in an improvement in students' performances and achievement.

Another such leadership training programme is Leadership for Learning (LfL) which was conducted in Ghana for training the basic school headteachers. Jull et al. (2014) conducted a mixed-method approach to study headteachers' perception on the LfL programme which was conducted between April 2009 to November 2011. After evaluation of the headteachers' responses to the questionnaire pertaining to LfL programme, the authors concluded that even though the headteachers might face barriers in implementing the ideas and principles of the programme into practice, they share positive perceptions about their relevance in leadership and learning practices.

There are also studies that report the effectiveness of such training programmes that had substantially improved the leadership pattern of the school leaders in South Africa. Naidoo (2019) used a mixed method approach to study how the deputy headteachers, head of the departments and post level-one teachers assess the leadership qualities of their school's principal who had graduated from the Advanced Certificate in Education: School Leadership and Management (ACELM) programme in South African schools. Over 70 percent of the respondents agreed that their principal who graduated from the ACELM programme ensured that the staff members created a positive climate for working in school, ensured that the financial committee was aware of the legal framework for formulating appropriate policy and over 60 percent agreed that their principal used different strategies depending on the circumstances; to sum up, all the respondents agreed that their schools' principals, who graduated from ACELM, often demonstrated more effective management skills. Furthermore, there is evidence which suggests that school management and training programmes can generate better outcomes in schools. Effectiveness of efficient school management programmes in reducing teachers' and student absenteeism in developing countries has been confirmed by a three-years long randomized controlled trial experiment by Blimpo et al. (2011). As a part of their experiment, the authors had randomly assigned Gambian schools to treatment group and control group to study the effectiveness of Whole School Development (WSD) programme in improving the school outcomes. WSD is a comprehensive school-based management and capacity building training programme targeted towards principals, teachers and other community representatives which was also associated with grant provision. To segregate the impact of the school-based training programme and the grant, the authors had constructed two treatment groups: one treatment group was provided training only whereas the other treatment group was provided the grant. The control group had obtained none of the two. After two years of intervention, there was an increase in the teacher and student involvement within the schools and it was characterized by reduced absenteeism among the teachers and the students within the treatment group which had received the training. However, there was no improvement in the students' test score over the years; the authors infer that this might result from the intervention which has successfully managed to involve even the students who were performing below the average standard.

However, the authors showed that the management training programme can only be effective if the adult literacy rate is at least 45 percent at the baseline within the localities. The grant only intervention, on the other hand, had no effect either on participation or test score.

### III. Methodology

In this study, we look at the effect of a school leader participating in the CPD programme on effective school leadership on student outcomes. At the level of student outcomes, we look at national student examination grades in English, Kinyarwanda, and Mathematics between 2015 and 2019, as well as the passing rate, in the final year of primary education (P6) and halfway secondary education (S3). The regression analyses in the results are done separately for each subject and measurement moment (P6 and S3).

#### 3.1. Experimental setup

We apply a quasi-experimental research design, using a difference-in-differences (DiD) framework. Schools with headteachers or deputy head teachers (HT/DHT) that have completed the CPD Training Programme on Effective School Leadership (intervention group) are compared with schools with HT/DHT that have not completed the CPD Training Programme (control group). In the DiD analysis, we furthermore compare the year of the treatment with the year immediately after the treatment, and the interaction between year and treatment. Schools with HTs and/or DHTs that have been trained in the cohort of 2015/16 (C0-cohort) or 2018/19 (C1-cohort), who successfully completed the CPD Training Programme are in intervention group C0 and intervention group C1, respectively (See Table 2). In intervention group C0, school leaders were selected and asked to participate based on their previous performance as a school leader. For power reasons, we combine the two treated cohorts in the analyses, where we compare the treated year (2015/16 for C0 and 2018/19 for C1) with the year thereafter. However, to get an idea whether one of the two cohorts might be driving these results, we also run the analyses for the two cohorts separately.

In the control group, schools are retained where neither the HT nor the DHT has been trained during the period between 2015 and 2019, also not by other Development Partners (DP). Furthermore, in the analyses we account for school leader rotation. This implies that we assign treated schools to the control group when their trained (D)HT as left the school soon thereafter, and we assign control schools to the treatment condition when their new (D)HT was in fact trained in the programme.

Table 2: Experimental design

Group	Observation 2015	Intervention 2015/16	Observation 2018	Intervention 2018/19	Observation 2019
<b>Intervention group 1</b> Schools with HT and/or DHT trained in Cohort 15/16	Oi1_0	Xi1	Oi1_1	--	Oi1_2
<b>Intervention group 2</b> Schools with HT and/or DHT trained in Cohort 18/19	Oi2_0	--	Oi2_1	Xi2	Oi2_2
<b>Control group</b> Schools where nor HT nor DHT is trained	Oc_0	--	Oc_1	--	Oc_2

Note:

- oi: Observation of the intervention group.
- oc: Observation for the control group
- Xi: Treatment of the Intervention group

The study matches participation data of (D)HTs for the CPD Programme with student performance and school-level data. All regressions include the following variables as controls: school size measured by number of students, share of female students, school category (public, private, or government-aided), school type (primary, secondary, 9-12 YBE or special needs education), the years of experience of the school leader and the district in which the school is situated. In the DiD analysis we furthermore cluster standard errors at the school level.

Apart from the overall analyses of comparing treated and control schools, with (1) and without (2) control variables, for the analyses for student examination grades, we also look at 3) whether it is the head teacher or the deputy head teacher that was trained, 4) whether the effect of the school leader training intervention differs by school type, 5) whether the effect differs by school category.

The dataset of the subsample of contacted schools contains of 253 treated C0 schools and 659 untreated schools in 2015, and 258 treated C1 schools and 701 untreated schools in 2018 (note that the control schools for C0 and for C1 are for a large part the same schools). However, the division of schools over treated and control changes if we consider school leader rotation. Furthermore, the sample size decreases if we consider if school leaders of control schools have been trained by VVOB (for example in the CPD Diploma Programme for School Leaders, in the next cohort, or other trainings by VVOB), and decreases even more if we also look at other trainings (not from VVOB) that took place in control schools. Note that this decrease in sample size is another reason to combine the two cohorts in the analyses, as the power is even lower now.

*Table 3 : Overview of the number of observations in each sample*

Sample	# Observations C0 (2015) P6		# Observations C0 (2015) S3		# Observations C1 (2018) P6		# Observations C1 (2018) S3	
	Treated	Control	Treated	Control	Treated	Control	Treated	Control
<b>All schools</b>	351	2,016	332	712	258	2,127	257	760
<b>Subsample with randomly selected control schools</b>	351	659	332	227	258	701	257	245
<b>Subsample without SL in control group trained by VVOB</b>	319	402	300	111	241	430	244	120
<b>Subsample without SL in control group trained by VVOB and others</b>	322	319	300	67	241	345	244	72

Using a dataset on all schools, with a maximum of 3078 schools (although not all schools are present in all years), with 351 and 326 treated schools in C0 and C1 respectively, a random control group was

drawn from this total sample to be contacted for additional information<sup>1</sup>. After conducting a priori power analysis considering an effect size of 0.15, we found that for our analysis we would need around 1,400 schools for a power of 0.80. Thus, provided that additional background information would be collected to support the analysis, it was decided to consider 800 schools in the control group. To select the schools to include in the study a simple random selection was conducted on the sample of 2,401 untreated schools. All treated and selected control schools were contacted for additional information on school leader training and school leader rotation. There were 52 treated and 83 control schools that could not be reached and are therefore removed from the dataset.

### 3.2. Student outcome measures

For all schools in the two intervention groups and in the control group, we will compare the average **examination results** of learners in Primary 6 (P6) and/or in senior 3 (S3) and passing rate for 2015 (pre-intervention), and 2019 (post-intervention). Short- and medium-term follow-up of student results is indeed necessary to account for changes due to the CPD over a longer period. In this research design, students could have been exposed to a trained school leader for 1 to 2 years at the most. Two years of exposure means that students that are in P6 at the time of evaluation were mostly in P4 at the time the HT or DHT participated in the CPD Training Programme. The average examination results for all subjects and pass rate we will use the database of the National Examination and School Inspection Authority (NESA). While for the dropout rates and repetition rates per school from 2015 to 2019, we will use MINEDUC database.

**Average examination results in P6 and S3 for all students:** This is calculated as total absolute value of students' marks of all subjects over the total number of candidates. **P6 and S3 pass rate:** This is the percentage of students who fulfilled the requirements to be granted the primary level and ordinary level (O-level) school certificate.

Since 2008 the Rwandan grading system is as follows; Marks (here also referred as aggregates) in one subject range from 1 - 9 grades with 1 being the best performer and 9 the worst performer. The grades are sub-divided into distinctions (grade 1 and 2), credits (Grade 3 to 6), passes (Grade 7 and 8) and unclassified or fail (Grade 9). In primary schools, students usually sit for five exams: Mathematics, Kinyarwanda, English, Social studies, and Elementary sciences. For instance, aggregates or marks for Mathematics are ranging from 1- the best score to 9 -the worst score. This means 1 \* 5 subjects= 5 as total highest scores, and 9\*5 subjects = 45 scores as total least scores. In secondary schools, O-level (S3) students sit for nine subjects: Mathematics, English, Kinyarwanda, Biology, Geography, Physics, Entrepreneurship, Chemistry and History. For each subject, the scores are aggregated from 1 to 9 as well, the average per students will then be 9 considered as outstanding and 72 considered as the lowest. Average score in one subject is calculated as sum of marks of all students in that subject divided by total number of students who sat for that subject exam. Students are grouped in 4 categories or divisions to further placing students in the same learning ability range (see Table 4).

Table 4: Aggregate range per division in primary and O - level<sup>2</sup>

Division	Aggregate range Primary	Aggregate range O-level
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<sup>1</sup> Note that the results for the general analysis without controls or interactions are very similar for the large sample compared with the smaller sample with the randomly drawn control group. However, the smaller sample allows us to make distinctions between types of schools and allows us to control for other training activities.

<sup>2</sup> REB (2018). Rwanda National Examination grading system.

<b>Division I</b>	5 - 15	Pass in at least 7 subjects and the aggregate not exceeding 32 in the best eight subjects.
<b>Division II</b>	16 - 30	Pass in at least 6 subjects and an aggregate not exceeding 45 in the best 8 subjects
<b>Division III</b>	31 - 37	Pass 5 subjects with credits in all of them and an aggregate not exceeding 58 in the best 8 subjects
<b>Division IV</b>	38 - 41	Pass one subject with 6 or higher or pass 2 subjects at grade 7 or pass three subjects at grade 8 and aggregate not exceeding 69 in the best 8 subjects
<b>Division U</b>	> 42	> 69

So, to be able to know the pass rate, it requires to know the number of students who are categorized into the 5 divisions. REB computes the pass rate as following: *Total number of students in (Division I, II, III, IV)/Total number of students in (Division I, II, III, IV, U)*. Therefore, only students who score division U are the ones who failed.

### **3.3. Analysis**

Eventually, the analyses are performed on a total of 641 (P6) and 367 (S3) schools for the C0 cohort and on 586 (P6) and 316 (S3) for the C1-cohort. Since mostly control schools were dropped from the sample due to training of their school leader, in the final sample we see that for the P6 analyses about half of these schools are treatment schools. For the S3 analyses this is even higher: more than 75% (see Table 3). Note that for the S3-analyses the number of observations in treated and control group were about equal after the random selection of control schools, but it seems that in secondary education, where the S3 national examinations take place, many more schools have school leaders trained by VVOB and other organisations. Also note that the distribution of background characteristics over treated and control schools has not changed once we have selected for other training programmes. However, it is also important to realise that for all samples that are presented in Table 3 are significant differences between treated and control schools on observable characteristics (school size, share of female students, school category, school type, years of experience and district), which is another reason why we explicitly control for these characteristics in the analyses. The DiD-analyses are performed on a total of around 2518 observations for the P6 analyses and around 1399 observations for the S3 analyses.

### **3.4. Ethical consideration**

This study was undertaken within the “Leading Teaching and Learning Together” programme. The data will be kept confidential and will by no means be linked to any personal/school information and will only be available to the researchers involved in this study.

## IV. Results

### ***4.1. Comparing treated and control schools***

The results in columns 1 and 2 of Table 2 in the appendix show a positive and significant effect of the interaction effect between treatment and time regarding the students' grades for the outcome variable English, both for P6 and for S3. This implies that the treated schools have a significantly higher score for English in the year immediately after the intervention than control schools. The negative and significant coefficient for the variable 'time' implies that all schools (both treated and untreated) have a lower score in the year after the intervention than in the year of the intervention. The positive and significant coefficient of the variable 'treatment' implies that treated schools perform better than untreated schools, both in the year before and the year after the intervention. All in all, we find a positive effect of school leader training on the English grades of students.

No significant interaction effect was found for the other subjects or for passing rate, as can be seen from the insignificant interaction between treatment and time, in columns 1 and 2 of Tables 3-5 in the appendix.

### ***4.2. Looking separately at whether the head teacher (HT) or deputy head teacher (DHT) is trained***

In the DiD-analysis we add the interaction between treatment in the year after the intervention with school leader position, which is presented in column 3 of tables 2-5 in the appendix. The results show that both in P6 and S3 the results in English are driven by DHT being trained (see table 1). Interestingly, when we then look at the other subjects, we see that for Kinyarwanda we do find a positive effect for S3 for when the HT is trained, but not for DHT. This implies that the overall insignificant effect for Kinyarwanda is driven by a contradictory effect for HT and DHT, leading to a too small overall effect to be significant. However, when we split the treated DHT and HT we see that there are in fact effects that can be identified. For mathematics we do not find consistent results between P6 and S3 and for passing rates, again no effects at all were found.

### ***4.3. Looking separately at whether a male (D)HT or a female (D)HT is trained***

In the DiD-analysis we add the interaction between treatment in the year after the intervention with gender of the trained school leader, which is presented in column 6 of tables 2-5 in the appendix. The results show that both in P6 and S3 the results in English are driven by male school leaders being trained (see table 1).

No significant interaction effect was found for the other subjects Kinyarwanda and mathematics for P6 and S3 and for passing rates, again no effects at all were found.

### ***4.4. Looking at differential effects by school category (government-aided, public, private)***

The results of the differential effects by school category, i.e., whether a school is government-aided, public, or private are presented in column 5 of tables 2-5 in the appendix. We only find a significant difference for English for P6, when the (D)HT of private schools are trained, the effect is higher than



when the (D)HT of government aided or public schools is trained. However, this should be seen in the light that private schools (treated or untreated) performed worse both in the year of the intervention and in the year directly thereafter. For English private schools are making up some of this negative difference by participating in the intervention, but the gap is still not closed completely.

We do not find a significant interaction effect for English in S3, nor for any of the outcomes for mathematics, Kinyarwanda, and the passing rate.

#### ***4.5. Looking at differential effects by school type (primary, secondary, both)***

Lastly, when we look at the interaction with school type (whether the school is 9-12 YBE, primary only, secondary only, or technical and vocational) in the DiD analysis (column 4 in tables 2-5 in the appendix), we do not see any significant differentiation effect by school type. Neither for P6, nor for S3.

#### ***4.6. Cohort comparison***

As a robustness check, we also run the analyses separately for the C0 and for the C1 cohort, in relation to the control schools. Note that the number of observations is smaller in the C1-cohort, and that we are likely to have a power problem, especially for the S3-outcomes. Nonetheless, the analyses separated by cohorts show that the overall results that are presented above seem to be driven by the C0-cohort. When separating the cohorts, we do not see any significant differences for the C1-cohort, whereas all significant coefficients that were found in the overall analyses are also present in the C0-cohort. Although it is possible that the effect for the C1-cohort is too small to be significant given the sample size, the coefficient is very small (near zero) and in some cases even in the wrong direction. This gives rise to suspect that the effect may be due to the self-selection into treatment for the C0-cohort. This will be further discussed in the conclusion below.

## V. Conclusions

In this study we analysed the effect of a continuous professional development training programme for school leaders in Rwanda, that we analyse quasi-experimentally using a difference-in-differences analysis for two trained cohorts, cohort C0 in 2015 and cohort C1 in 2018. We studied the effect of the CPD programme of the two cohorts combined (as well as separately as robustness check) on student performance in primary and secondary education for English, Kinyarwanda, Mathematics, and the passing rate.

The results show a positive and significant effect for English for students in treated schools in the year immediately after the intervention, both for P6 and for S3. No overall effect was found for the other subjects. However, interaction analyses with school leader position show that both in P6 and S3 the results in English are driven by DHT being trained. For Kinyarwanda we do find a positive effect for when the HT is trained, but not for DHT. For Math the results for HT and DHT separately are not consistent, and for passing rates no differential effects were found. For English in P6 we find that the treatment is particularly effective in private schools, in comparison with government aided schools. The robustness analyses in which we separate the cohorts suggest that the above-described results are driven by the C0-cohort.

An important thing to keep in mind is the difference in allocation to the treatment between the two cohorts. The C0-cohort was selected based on school leader performance, including their English proficiency (which to some extent might explain why we might only find an effect for English), whereas the C1-cohort was selected completely randomly. Since based on these analyse it seems that the found overall effect is driven by the C0-cohort, it is possible that the effect is indirectly due to other characteristics of the participating school leaders/schools, characteristics that also make it a high-quality school, or that motivation of the participants plays a role here. Therefore, we have to make sure to repeat this study including newer cohorts to confirm the results found in the current study.

Another potential reason for not finding effects for other subjects than English and for the C1-cohort is that it might take more time for the effect for particularly the C1-cohort to become large enough that it is detectable, due to the given the unequal division between treated and control schools, especially for the S3 outcomes. Unfortunately, we only have data one year after the C1 cohort was treated, so we cannot look at a potential longer-term effect, or an increase in the effect size in the longer run. Especially given the lack of a clear trend before the treatment year it is possible that it takes longer for this cohort to show effects. It is therefore also advisable to add newer data as soon as these come available to check whether the effect for the C1-cohort may take more time to show.

We conclude that the CPD-intervention was effective to increase English performance, and when HT are trained also for Kinyarwanda, for both P6 and S3. This implies that the intervention was partly effective, and that the effects are very consistent between P6 and S3. However, we need to further investigate the differences between effect in subject and between type of school leader position. In quantitative research, this could potentially include later trained cohorts as well for more robust results and a better power. Qualitative research could be used to interview HT and DHT to find out whether participating in the training program has different effect on their everyday work and could involve observing classrooms of the different subjects, and interviewing teachers to find out how it can be explained that an effect is found for English (and for Kinyarwanda for HT), but not for the other subjects or for the passing rate.

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## VII. Appendix

Table 1a: Difference-in-Differences Regression Results English – P6

	P6					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.389*** (0.0877)	0.0689 (0.0577)		0.192*** (0.0618)	0.0851 (0.0627)	
Time	-0.292*** (0.0338)	-0.249*** (0.0302)	-0.251*** (0.0302)	-0.161*** (0.0267)	-0.150*** (0.0312)	-0.249*** (0.0302)
Interaction treatment x time	0.114** (0.0449)	0.0719* (0.0405)			0.0227 (0.0442)	
Interaction treated HT x time			0.0105 (0.0814)			
Interaction treated DHT x time			0.0854** (0.0414)			
Interaction school type (Primary only vs 9-12) x time x treatment				-0.0451 (0.0854)		
Interaction school category Private (vs. gov. aided) x time x treatment					0.655*** (0.203)	

Interaction school category Public (vs. gov. aided) x time x treatment					-0.0645 (0.0876)	
Interaction treated female x time						0.0252 (0.0734)
Interaction treated male x time						0.0874** (0.0420)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	2,522	2,522	2,522	2,522	2,522	2,522
<i>R2</i>	0.031	0.692	0.696	0.695	0.697	0.694

Table 1b: Difference-in-Differences Regression Results English – S3

	S3					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.696*** (0.207)	-0.287** (0.114)		-0.0742 (0.0819)	-0.240 (0.152)	
Time	0.261*** (0.0821)	0.201*** (0.0628)	0.201*** (0.0628)	0.309*** (0.0343)	0.157* (0.0881)	0.189*** (0.0639)
Interaction treatment x time	0.0953* (0.0896)	0.142* (0.0728)			0.187* (0.0983)	
Interaction treated HT x time			-0.281*** (0.0965)			
Interaction treated DHT x time			0.249*** (0.0746)			
Interaction school type (Primary only vs 9-12) x time x treatment				0.102 (0.169)		
Interaction school category Private (vs. gov. aided) x time x treatment					-0.236 (0.385)	
Interaction school category Public (vs. gov. aided) x time x treatment					-0.0972 (0.147)	
Interaction treated female x time						0.106 (0.107)
Interaction treated male x time						0.163**



						(0.0755)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>
<i>R2</i>	<i>0.074</i>	<i>0.620</i>	<i>0.626</i>	<i>0.626</i>	<i>0.622</i>	<i>0.616</i>

Table 2a: Difference-in-Differences Regression Results Kinyarwanda – P6

	P6					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.226*** (0.0709)	-0.0954 (0.0670)		-0.143* (0.0749)	-0.0328 (0.0801)	
Time	-0.0925*** (0.0310)	-0.0964*** (0.0278)	-0.0953*** (0.0278)	-0.0867*** (0.0268)	-0.0698** (0.0348)	-0.0956*** (0.0278)
Interaction treatment x time	0.0400 (0.0428)	-0.00267 (0.0392)			-0.0173 (0.0490)	
Interaction treated HT x time			-0.0276 (0.0623)			
Interaction treated DHT x time			0.00111 (0.0419)			
Interaction school type (Primary only vs 9-12) x time x treatment				-0.0498 (0.0845)		
Interaction school category Private (vs. gov. aided) x time x treatment					-0.147 (0.181)	
Interaction school category Public (vs. gov. aided) x time x treatment					0.0375 (0.0876)	
Interaction treated female x time						0.0202

						(0.0664)
Interaction treated male x time						-0.00803 (0.0416)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	2,522	2,522	2,522	2,522	2,522	2,522
<i>R2</i>	0.013	0.454	0.456	0.455	0.455	0.458

Table 2b: Difference-in-Differences Regression Results Kinyarwanda – S3

	S3					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.282* (0.144)	-0.335*** (0.106)		-0.271*** (0.0940)	-0.185 (0.146)	
Time	-0.465*** (0.0754)	-0.482*** (0.0680)	-0.483*** (0.0679)	-0.478*** (0.0320)	-0.504*** (0.0951)	-0.494*** (0.0680)
Interaction treatment x time	0.0297 (0.0821)	0.0253 (0.0749)			0.0700 (0.102)	
Interaction treated HT x time			0.153* (0.0914)			
Interaction treated DHT x time			-0.00559 (0.0769)			
Interaction school type (Primary only vs 9-12) x time x treatment				0.188 (0.119)		
Interaction school category Private (vs. gov. aided) x time x treatment					-0.195 (0.241)	
Interaction school category Public (vs. gov. aided) x time x treatment					-0.129 (0.166)	
Interaction treated female x time						-0.0442

						(0.103)
Interaction treated male x time						0.0644 (0.0761)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>
<i>R2</i>	<i>0.060</i>	<i>0.395</i>	<i>0.398</i>	<i>0.397</i>	<i>0.402</i>	<i>0.401</i>

Table 3a: Difference-in-Differences Regression Results Mathematics – P6

	P6					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.338*** (0.0909)	-0.0666 (0.0717)		-0.228*** (0.0701)	-0.110 (0.0783)	
Time	0.243*** (0.0350)	0.246*** (0.0292)	0.248*** (0.0292)	0.251*** (0.0308)	0.279*** (0.0337)	0.247*** (0.0292)
Interaction treatment x time	0.0323 (0.0500)	-0.0219 (0.0448)			-0.0486 (0.0518)	
Interaction treated HT x time			-0.198** (0.0781)			
Interaction treated DHT x time			0.0103 (0.0476)			
Interaction school type (Primary only vs 9-12) x time x treatment				-0.192** (0.0873)		
Interaction school category Private (vs. gov. aided) x time x treatment					-0.0270 (0.304)	
Interaction school category Public (vs. gov. aided) x time x treatment					0.0413 (0.101)	

Interaction treated female x time						0.0960 (0.0847)
Interaction treated male x time						-0.0496 (0.0475)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	2,522	2,522	2,522	2,522	2,522	2,522
<i>R2</i>	0.024	0.578	0.583	0.584	0.581	0.579

Table 3b: Difference-in-Differences Regression Results Mathematics – S3

	S3					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.615*** (0.183)	-0.0947 (0.120)		0.0398 (0.0961)	0.0177 (0.168)	
Time	0.613*** (0.0739)	0.565*** (0.0621)	0.567*** (0.0623)	0.439*** (0.0274)	0.570*** (0.0980)	0.547*** (0.0659)
Interaction treatment x time	-0.112 (0.0796)	-0.0860 (0.0689)			-0.0944 (0.104)	
Interaction treated HT x time			0.0616 (0.0898)			
Interaction treated DHT x time			-0.125* (0.0706)			
Interaction school type (Primary only vs 9-12) x time x treatment				0.349** (0.169)		
Interaction school category Private (vs. gov. aided) x time x treatment					0.439 (0.302)	
Interaction school category Public (vs. gov. aided) x time x treatment					-0.0239 (0.141)	



Interaction treated female x time						-0.140 (0.0901)
Interaction treated male x time						-0.0448 (0.0740)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>
<i>R2</i>	<i>0.085</i>	<i>0.537</i>	<i>0.540</i>	<i>0.553</i>	<i>0.544</i>	<i>0.532</i>

Table 4a: Difference-in-Differences Regression Results Passing rate – P6

	P6					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.0106 (0.00996)	0.0104 (0.0106)		0.0200* (0.0116)	0.00783 (0.0127)	
Time	0.00159 (0.00517)	0.00246 (0.00462)	0.00239 (0.00462)	0.00988** (0.00480)	0.00267 (0.00635)	0.00212 (0.00463)
Interaction treatment x time	0.00508 (0.00739)	0.00989 (0.00696)			0.00723 (0.00920)	
Interaction treated HT x time			0.00659 (0.0134)			
Interaction treated DHT x time			0.0106 (0.00733)			
Interaction school type (Primary only vs 9-12) x time x treatment				0.0108 (0.0150)		
Interaction school category Private (vs. gov. aided) x time x treatment					-0.00712 (0.0115)	
Interaction school category Public (vs. gov. aided) x time x treatment					0.0110 (0.0151)	

Interaction treated female x time						0.00860 (0.0126)
Interaction treated male x time						0.0107 (0.00737)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	2,522	2,522	2,522	2,522	2,522	2,522
<i>R2</i>	0.001	0.269	0.270	0.269	0.269	0.270

Table 4b: Difference-in-Differences Regression Results Passing rate – S3

	S3					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.0224 (0.0178)	0.0402*** (0.0155)		0.0281* (0.0145)	0.0294 (0.0200)	
Time	0.0318*** (0.0110)	0.0340*** (0.0106)	0.0341*** (0.0106)	0.0297*** (0.00455)	0.0424*** (0.0157)	0.0281 (0.0582)
Interaction treatment x time	-0.0103 (0.0119)	-0.00951 (0.0114)			-0.0184 (0.0164)	
Interaction treated HT x time			-0.000180 (0.0144)			
Interaction treated DHT x time			-0.0119 (0.0116)			
Interaction school type (Primary only vs 9-12) x time x treatment				-0.00425 (0.00739)		
Interaction school category Private (vs. gov. aided) x time x treatment					0.0302 (0.0266)	
Interaction school category Public (vs. gov. aided) x time x treatment					0.0152 (0.0241)	

Interaction treated female x time						-0.00548 (0.0143)
Interaction treated male x time						-0.0137 (0.0116)
Control variables	No	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>	<i>1,412</i>
<i>R2</i>	<i>0.017</i>	<i>0.272</i>	<i>0.272</i>	<i>0.275</i>	<i>0.277</i>	<i>0.269</i>



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