Improving Public Sector Service Delivery: The Importance of Management

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August 29, 2021

Abstract

Deficient public sector management in developing countries can constrain service delivery due to the complementarity between manager and worker effort. Through a 210 school randomized controlled trial we compare T1) training teachers and managers in differentiated instruction (teaching at students' learning levels) and providing managers a classroom practices checklist; T2) T1 plus training on managerial best practices focused on "People Management"; and a control group. Both interventions equally increased standard measures of school management focused on instructional practices and student test scores 0.11SD, 30 percent of a learning-year. T2 differentially improved standard measures of People Management but not productivity. The simple, objective checklist increased the impact of teacher training relative to other similar trainings. One year later, the interventions had persistent effects on management quality without additional training.

JEL Codes: H40, I25, I28, M53, M54, O15, O43

Keywords: managers, management, education, primary school, targeted instruction, teaching at the right level, external validity, differentiated instruction

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1 Introduction

Public service provision in developing countries is often deficient. Specifically in education, the stark differences between countries in the amount of education students acquire per year of schooling demonstrate the variation in productivity levels between countries and the lack of productivity in some countries. Obvious evidence of low quality management in schooling includes teachers and principals being frequently absent, many teachers who are present are not teaching, and schools have substantial year over year teacher turnover. Management quality is correlated with more productivity both in the private (e.g. Bloom and Van Reenen 2007; Hsieh and Klenow 2009) and public sectors (Rasul and Rogger 2018; Tsai et al. 2015; Bloom et al. 2015; Lemos and Scur 2016; Crawfurd 2017; Lemos et al. 2021) yet most evidence on improving management is from the private sector. Many tools used to improve productivity in the private sector are unavailable in the public sector–public sector management is constrained by rigid hierarchies and pay structures, weak incentives, and limited scope for hiring and firing. Yet, given the likely complementarity between worker and management effort as in the private sector, inadequate public sector management both suppresses existing productivity and reduces the likelihood that promising reforms are implemented correctly. This paper focuses on both frontline civil servants and their managers and asks two related questions about public sector management: 1) can public sector managerial capacity be increased? 2) what changes in managerial skills are most salient to combine with working training to improve productivity?

To answer these questions we partnered with the Ministry of Education in Ghana to create a three armed randomized controlled trial (RCT) focusing on the relative and absolute importance of three aspects of management–Instructional Management, People Management, and Other Management, three aspects highlighted in the World Management Survey (WMS) (Bloom et al. 2015). Instructional Management focuses on what happens in the classroom, People Management measures how the teaching and supervisory agents interact, and Other Management encompasses additional management tasks that are not directly related to

instruction or supervision.

The treatments reflected the realities, confines, and interests of the Ghanaian education sector and were randomized across 210 schools in 20 districts across 8 of 10 regions of Ghana during the 2018-2019 academic year. In Treatment 1, teachers received training in and materials for differentiated instruction (teaching students at their learning level instead of grade level across three primary school grades). Additionally, school principals and supervisors received guidance to improve their basic management. They attended the differentiated instruction training and were encouraged to support their teachers by observing teaching and completing a check-list that highlighted the elements of differentiated instruction. Together this intervention focused on the Instructional Management elements from the WMS–standardization of instructional planning processes, personalization of instruction and learning, data-driven planning and student transition, and performance tracking. Treatment 2 had all the components of Treatment 1 plus an additional, multiple-day enhanced management training and associated materials for principals and supervisors that focused on People Management–mentoring and improving the collaborative nature of their relationships with teachers. The final group was the control group that continued with business as usual. All material design and distribution and training was implemented by existing government civil servants under the Ghanaian Ministry of Education umbrella.

Both interventions increased management quality, improved classroom operations, and increased student test scores. Both interventions increased the Instructional Management index by 0.4 standard deviations (SD) relative to the control group. The intervention that included the enhanced management training increased the People Management index by about 0.6SD relative to the control schools and twice the increase in the intervention that did not include Enhanced Management training. Finally, aspects of Other Management increased equally across the two arms even though they were not specifically covered in the training but could readily follow when managers were more engaged. Therefore, the management components of two interventions were effective.

The two interventions resulted in more engaged principals, teachers, and students and teachers implemented the program in their classrooms. These changes to school and classroom operations were approximately equal across the two interventions, even though the intervention with enhanced management differentially improved the People Management Index. Principals were about 11 percentage points (26 percent) more likely to be present, teachers were about 12 percentage points (18 percent) more likely to be in the classroom and 17 percentage points (37 percent) more likely to be engaged with students, and classrooms were more student-centered with a 17 percentage point (35 percent) increase in the likelihood that a student spoke during an observation. About 60 percent of schools had divided their students by learning levels across three primary grades during unannounced visits. The interventions further changed the teachers' and principals norms–teachers were less accepting of shirking by their peers and principals, and.principals held teachers to higher standards. Perhaps due to increased effort or expectations, teachers in the intervention that included enhanced management reported a higher incidence of work related stress and burnout.

After approximately one year of exposure to this intervention, student test scores increased by about 0.11 SD on a combined test of mathematics and English that included both grade level and foundational material. Relative to the control group, this was an additional one third of a year of schooling. When considering the subjects separately, math scores increased about 0.13 SD and English scores increased about 0.07 SD. Across all the two interventions, the point values are very similar (at most 0.01SD different), and we fail to reject that the two interventions had the same effect.

Implementation persisted in the school year after the intervention even in the absence of additional materials and limited training for only one teacher per school. Because the intervention required teachers of three grades to work together and new teachers would not have been centrally trained, the leadership and support of the principal was more important in this second year. In this year in which only school leaders and supervisors provided support, about 40 percent of schools divided their students by learning level for part of the

school day, 70 percent of the year 1 effect, equal across both treatments. The persistence of the intervention again points to the importance of Instructional Management.

We attribute these improvements in management, operations, and test scores to the complementarity between management and teacher training–a previous intervention that provided a similar training only to teachers did not improve learning after one year (Duflo, Kiessel, and Lucas 2021). Therefore, improvements in Instructional Management generated by the combination of training in differentiated instruction and basic management appear key to improving student learning.

In addition to its policy relevance, our paper makes three related contributions to the economics literature. First, in contribution to the literature on public sector management, the intervention improved school management and shows that, while both are correlated with baseline student test scores, Instructional Management is more important for student learning than People Management. In the private sector, firms with more effective management are more productive (e.g. Bloom and Van Reenen 2007; Hsieh and Klenow 2009; see summary in Bloom and Van Reenen 2011). Further, consulting firms can increase private sector firm productivity (Bloom et al. 2013; Bloom et al. 2018; Bruhn et al. 2018). Considering public sector entities as firms is a more recent literature, which similarly started with correlations–higher quality management practices were associated with the more project completion (Nigerian Civil Service) or higher quality outcomes (hospitals in the US and England) (Rasul and Rogger 2018; Tsai et al. 2015). Specifically in education, our estimate of a 1SD increase in management quality being correlated with a 0.15SD higher student test scores is in the middle of previous estimates of 0.06 to 0.4SD higher test scores across other countries (Bloom et al. 2015; Lemos and Scur 2016; Crawfurd 2017; Lemos et al. 2021). Few papers attempt to change management quality in the public sector. A 2017 systematic review found no studies that trained the managers of front-line civil servants in developing countries (Finan et al. 2017).[1] Recent studies have sought to improve school

[1]The evidence in developed countries is further scant and often involves massive (300 hour) time investments (Fryer 2017).

management improvement through the outsourcing of management to private sector firms (Romero, Sandefur, and Sandholtz 2020), creating coaching or training layers parallel to the existing system (Cilliers et al. 2020a; Cilliers et al. 2020b), lengthy programs provided by international foundations (Ganimian and Freel 2020), or encouraging continuous assessment and/or school improvement plans (de Hoyas et al. 2019; Berry et al. 2020; Muralidharan and Singh 2020). We show that increasing management quality within existing systems is possible and that a classroom observation checklist was as effective in increasing student test scores as a more elaborate multi-day management training even though the more general management training differentially improved management quality.

Second, we show the complementarity of providing teachers with training in superior teaching methods, in this case differentiated instruction, and improving school management. When implemented within existing government management and supervision structures, previous studies found training in and materials for differentiated instruction led to no increase in test scores after one year (Banerjee et al. 2017; Duflo, Kiessel, and Lucas 2021). Our effect sizes are similar in magnitude to the version implemented under careful NGO supervision (Banerjee et al. 2017). As with teacher training alone, others have found that neither capacity building workshops nor development of school improvement plans improved student test scores after one year (de Hoyas et al. 2019; Muralidharan and Singh 2020).[2] This complementarity between teacher training and management engagement has implications for scaling other successful NGO or researcher-initiated programs, particularly differentiated instruction, which is currently being implemented in ten different African countries in addition to Ghana, affecting 70 million school children at scale (TaRL 2020).

Third, the entire intervention from the design of the materials to the implementation was undertaken by the government showing that existing government structures have spare capacity and can take effective programs to scale with sufficient political will without outsourcing to private providers or NGOs. Expanding access to effective programs through government

[2]de Hoyas et al. (2020) found positive effects on student passing rates and reduction in failure rates two years after the conclusion of a two year performance management intervention.

implementation is neither trivial or obvious. Well-designed programs may prove effective when implemented at a smaller scale, but a scaled-up government-led implementation is both more complicated and necessary for these program to achieve broader impact (Muralidharan and Niehaus 2017; Bold et al. 2018). Previous attempts to scale NGO-initiated education programs within existing systems have shown the challenges of government implementation (Banerjee et al. 2017; Bold et al. 2018; Muralidharan and Singh 2020). In other contexts, bureaucratic inefficiencies and limitations to state capacity in program implementation are broadly documented (Muralidharan, Niehaus, and Sukhtankar 2016). Vivalt (2020) confirms that across studies, government-implemented programs have smaller effect sizes than those implemented by academics or NGOs. Lack of capacity, support structures, and systems of accountability influence the state's ability to deliver efficient and effective services (Finan, Olken, and Pande 2017). Ghana's government effectiveness based on the Worldwide Governance Indicators is above the average for sub-Saharan Africa, but below that of India's and the worldwide median (World Bank 2018). Therefore, we do not claim that something is particularly special or effective about the government of Ghana, instead that this program was broadly embraced and integrated into the education system instead of being seen as an outside imposition.

2 Background on the Ghanaian Education Sector

As with many other countries, Ghana is beset with the challenge of heterogeneous classrooms and low average student achievement (Glewwe and Muralidharan 2016; Ministry of Education 2018; Dulfo, Kiessel, and Lucas 2021). Primary schools in Ghana are grades 1 (P1) through 6 (P6). In primary schools teachers are classroom teachers, teaching all subjects to their assigned students. This intervention focuses on upper-primary grades, grades 4 through 6. After completion of grade 6, students continue to Junior High School for grades JHS1 through JHS3, similar to grades 7 through 9 in the US. Government schools should not charge tuition. At the conclusion of JHS3, students can continue on to secondary school

for an additional three years in either an academic or vocational track. The official language of instruction is English starting in grade 4.[3]

At the time of the intervention, the Ghanaian school year started in mid-September and ended in late July. Each school year is divided into three 12-14 week terms with 25 days of holidays before Terms 2 and 3.

Government primary schools in Ghana are under the purview of Ghana Education Services (GES), a Ministry of Education (MoE) agency that is responsible for the implementation of all pre-tertiary educational policies in Ghana. Government primary school teachers are employed centrally by GES who assigns each teacher to a specific school and is responsible for all teacher transfers between schools. A head teacher, known as a school principal or school leader in other contexts, oversees each school. Head teachers are almost always previous classroom teachers. Most do not have any additional formal training prior to becoming a head teacher and 28 percent never had any principal-specific training prior to this intervention. Each school belongs to a circuit of approximately 9 geographically proximate schools, overseen by a circuit supervisor. As with head teachers, circuit supervisors are almost always previous teachers and, like head teachers, receive almost no additional formal training. Circuit supervisors act as liaisons between the school and the District Education Office.

3 Intervention

A school based intervention can target managers (i.e. principals), workers (i.e. teachers), neither, or both. Most studies to improve classroom activities focus on teachers while providing strong management support from an NGO or a research team. Those studies that have focused exclusively on teachers without additional support have not improved learning after one year, including those with a similar pedagogy design in Ghana and India (Banerjee

[3]In lower primary school, the official language of instruction is the National Literacy Acceleration Program (NALAP) language assigned to each school. The NALAP languages are assigned at geographic units larger than a school and do not always match the actual local language of the school.

et. al 2017; Duflo, Kiessel, and Lucas 2021). Similarly, those that have focused exclusively on management have not improved learning after one year (Karthik; Ganimian;). Therefore, the salient interventions are one in which both managers and workers are engaged, leveraging the potential complementarity between these layers of the civil service.[4] We test the effect of two different versions of a combined principal and teacher intervention relative to each other and a control arm. All material development and training occurred using existing government personnel and systems. We briefly describe each treatment below. Appendix sub-section A.1 contains additional details.

3.1 Treatment 1–Differentiated Instruction + Basic Management

Differentiated Instruction

Teachers, head teachers, and circuit supervisors received training in and materials to implement differentiated instruction. To implement differentiated instruction at the start of each term, teachers in grades 4 through 6 were to test students in both English and math using a simple tool, modeled after the annual status of education report (ASER) assessment in India, that determined students' learning levels. For one hour each day, four days per week, 8 weeks per term, the teachers of grades 4 through 6 were to divide their students by learning level instead of grade level, differentiating their instruction based on the learning level of the student instead of the grade level.[5] The intervention particularly emphasized the importance of foundational skills on which grade-level competencies could be built. It also encouraged student engagement rather than rote, passive memorization. The teaching and learning materials supported a more active, learner centered teaching practice, but were not scripted lessons.

Basic Management

[4]More formally, consider an intervention that can target workers (w) or managers (m) with each intervention denoted as (w, m). An exhaustive program design would be $(0, 0)$, $(1, 0)$, $(0, 1)$ and $(1, 1)$. Studies have shown that $(1, 0)$ without additional external support is ineffective. Similarly $(0, 1)$ has also been show to be ineffective. Therefore we focus on two versions of $(1, 1)$ relative to each other and $(0, 0)$.

[5]Students could be in a different math and English levels, and they could move between levels during the school year as their progression warranted.

The basic management intervention focused on Instructional Management. Head teachers and circuit supervisors were invited to the teacher training and then provided a GES-designed classroom observation form that emphasized the core components of differentiated instruction–dividing students by learning level, teaching at the level of the student, and engaging in active, student centered pedagogy. They were encouraged to use this checklist in their routine observation of teaching, providing them a straightforward task to complete. While some elements of the checklist were differentiated instruction specific, e.g. dividing students by learning level, others were part of a broadly more engaged teaching practice and could be used during non-differentiated instruction time. This replaced an existing form that focused primarily on whether students were completing exercise books at the expected rate and the teacher was covering the assigned annual curriculum.

To ensure government ownership of the interventions and in response to interest from national level education personnel, each term a national level monitoring team visited each study district to observe the intervention.[6] They visited 88 percent of treatment schools each term. This further signaled to the teachers, head teachers, circuit supervisors, and district education officials that this intervention had the support of the national leaders in education.

3.2 Treatment 2–Differentiated Instruction + Basic Management + Enhanced Management

Treatment 2 received the same differentiated instruction and basic management interventions as in treatment 1.

Enhanced Management

To improve People Management, head teachers and circuit supervisors received additional training, a handbook, and quick reference cards on how to be effective supporters of teachers both during differentiated instruction and in their broader teaching practice. At the conclusion of the training, head teachers and circuit supervisors received a phone number

[6]National level monitors visit schools as regular policy, but less frequently, visiting about 16 percent of schools each year. When education reforms are implemented in Ghana, this monitoring design is common.

that they could call or text with questions or concerns, effectively a "help-desk." During the implementation of the program, head teachers received automated, supportive text messages on a weekly basis to remind them of key targeted instruction components and dates, e.g. "Remember to conduct the student leveling this week." Unlike the task-based instructional management above, this intervention was more holistic and sought to transform the relationship between teachers and their two immediate layers of supervisors into one of collaborative support for improved learning.

4 Empirical Strategy

The primary conceptual difficulty in estimating the effect of management quality on classroom activities and student outcomes is its potential correlation with other unobserved aspects of the school that also influence the same outcomes. To overcome this difficulty, we conducted a randomized controlled trial. We randomized 210 schools into one of three treatments: differentiated instruction plus basic management (DIB), differentiated instruction plus basic and enhanced management (DIBE), and control. From this randomization design, estimation of treatment is straightforward. Specifically we estimate,

$$y_{is} = \alpha + \beta_1 DIB_s + \beta_2 DIBE_s + \Gamma' X_{is} + \varepsilon_{is} \tag{1}$$

where y_{is} is outcome y for respondent i in school s, DIB_s is an indicator variable equal to one if the school was a the differentiated instruction plus basic management treatment, $DIBE_s$ indicates schools in the differentiated instruction plus basic and enhanced management treatment, X_{is} are a vector of school and individual level controls including strata fixed effects and baseline level y_{is} as appropriate, and ε_{is} is a cluster-robust error term assumed to be uncorrelated between schools but allowed to be correlated within a school. In student level regressions, to improve precision we additionally control for student age and age squared, baseline grade level, and an indicator variable for being female.

In this specification, each β is the effect of each treatment relative to the control group. The difference between $\beta_1$and β_2 is the differential effect of the enhanced management training.

We test the impact of the treatments on school management practices and norms, classroom activities, program implementation, and students' test scores, attendance, and persistence in school.

5 Sample Selection and Data

In this section we first describe how we constructed the sample and then the data collected.

5.1 Sample Selection and Randomization Procedure

This study occurred in 20 districts spread across eight of ten regions of Ghana.[7] These districts contained 145 circuits, i.e. sets of geographically proximate schools overseen by a single circuit supervisor. We excluded 5 circuits from the study ex ante, leaving 140 study circuits.[8]

From the 140 study circuits, we randomly assigned 70 circuit supervisors to receive the DI + Basic Management intervention and 70 circuit supervisors to receive the DI + Basic + Enhanced Management intervention. We randomly selected two eligible schools from each circuit. Within each of the DI + Basic Management circuits, we randomly allocated one of the two eligible schools to be a control school and the other eligible school to be a DI + Basic Management school. To be consistent across all circuits, within each of the DI +

[7]The districts were between the 77th and 1st (lowest) percentile of the national district level poverty ranking. These districts were selected because one of the funders of the implementation, the United Nations Children's Fund (UNICEF), had existing relationships with these districts.

[8]We excluded two circuits to use for piloting. Three additional circuits were excluded because they did not have at least two primary schools that met the eligibility criteria: they had to operate one shift per day and have positive enrollment and separate sections for P4 through P6. Schools with shifts have altered time-tables that would not be amenable to differentiated instruction time, and schools with multiple grades taught in a single classroom would not have enough teachers to separately teach three learning levels. Our initial universe of schools was from the union of the official Education Management Information System (EMIS) and the United Nations Children's Fund (UNICEF) rosters of schools. Because neither the EMIS nor UNICEF data contained the relevant details, we contacted each school to confirm its characteristics.

Basic + Enhanced Management circuits, we randomly selected one of the two eligible schools to receive the DI + Basic + Enhanced Management intervention and removed the second school from the study. Our sampling strategy ensures that the circuit and school selection is identical in the two groups. The resulting experimental sample is 210 schools. The study design is pictured in Figure 1. As circuit supervisors of control schools received the DI + Basic intervention, our estimates are lower bound of the overall effect size relative to a pure control school. The effect of a trained CS on an otherwise untreated school is likely small. They were instructed not to use the DI observation form in non-DI schools, and we did not observe any control schools dividing their students by learning levels. As the previous versions of DI were barely implemented and the methods did not transfer even between educators in the same school, spillovers are unlikely (Duflo, Kiessel, and Lucas 2021). If spillovers happened, they will bias our results towards 0.

[Figure 1 about here]

This scheme results in three intervention arms, i.e. two treatment arms and one control arm, with 70 schools in each arm. Our design has the advantage of allowing us to measure the impact of DI + Basic Management compared to business-as-usual, and the impact of DI + Basic + Enhanced compared to business-as-usual. It also allows us to compare the differential effect of adding the Enhanced Management intervention relative to the DI + Basic Management intervention alone. In all cases we establish both effectiveness and cost-effectiveness.

5.2 Data Collection

To evaluate the effect of the two interventions, we conducted four full rounds of data collection–a baseline prior to implementation, two monitoring checks during the implementation year, and a follow-up survey in the final term of the implementation year–and a truncated monitoring round the year after the intervention. The full project timeline appears in Figure 2.

[Figure 2 about here]

Baseline

To ensure a baseline prior to any students receiving treatment, the baseline occurred in May and June 2018, near the end of the 2017-2018 academic year, with the training occurring in August 2018 between the 2017-2018 and the 2018-2019 academic years.

During baseline data collection we surveyed all 140 circuit supervisors and the head teachers and P4 through P6 teachers at each of the 210 study schools on their backgrounds and existing management and teaching practices. Additional details on the management measures appear in Section 5.3. We further surveyed and tested a random sample of 30 students from each school, 15 from P4 and 15 from P5.[9] The student assessments included both foundational and grade level content. Additional details on test construction appear in Appendix Section A.2. Because test questions were designed to cover grades P1 through P6 content, we used item response theory to compute an overall test score and standardize based on the baseline mean and standard deviation. We surveyed and tested 5,893 students at baseline.

Spot-checks

We conducted two spot-check visits during the 2018-2019 school year, one in Term 1 and one in Term 2. During each spot-check visit enumerators arrived unannounced and recorded the attendance of the head teacher, teacher, and baseline students. Circuit supervisors, head teachers and teachers responded to surveys on program take-up and implementation and management. We also conducted two classroom observations during the first two periods of the day in each P4 through P6 classroom, noting teacher presence, whether students were divided by grade level instead of learning level, and the use of teaching and learning materials. We further collected basic demographics on any new head teachers or teachers since the baseline.

[9]If a school had more than one section of a grade, we first randomly selected a section then selected students from that section. If a school had fewer than 15 present students, we surveyed and tested all students who were present.

Achievement Follow-up

At the end of the 2018-2019 school year, we attempted to survey and invigilate exams for all baseline students. These tests were similar to those at baseline, but included additional harder questions with some of the easier questions removed. In addition we conducted circuit supervisor, head teacher, and teacher interviews. These surveys collected information on school enrollment, organization and management, teacher support, mentorship, and program implementation.

Post-Intervention Spot Check

We started an additional spot-check round during the second term of academic year 2019-2020, the year after the end of the intervention. In March of 2020, we stopped field activities after reaching only 60 percent of schools for the safety of our enumerators and study participants due to increasing Covid-19 transmission in Ghana. The content of this incomplete round was similar to the previous spot-check rounds.

5.3 Management Indices

We used the previously validated Development World Management Survey (D-WMS) as a framework for the measurement of managerial practices (Lemos and Scur 2016). Because of the content of the interventions, we focus on three measures of management–Instructional Management, People Management, and Other Management–creating an index to capture each. In each case, we followed Anderson (2008) to standardize and combine data reported by teachers, head teachers, and circuit supervisors to create each index.The exact questions for each index appear in Appendix Section A.3.

Instructional Management

The Instructional Management Index captures of the elements of the D-WMS that were directly targeted by the implementation of the DI + Basic Management intervention–standardization of instructional planning processes, personalization of instruction and learning, data-driven planning and student transition, and performance tracking.

People Management

The People Management Index captures the elements of the D-WMS that were targeted by the Enhanced Management Training–performance review and performance dialogue.

Other Management

The final index includes all other aspects of management not directly covered in the training but which could naturally follow from other improved practices–adopting educational best practices, continuous improvement, and consequence management.

As validation of these measures, we show that each is positively correlated with student test scores in Appendix Figure A2.

5.4 Summary Statistics and Baseline Balance

Table 1 displays the summary statistics and tests for baseline balance across the three treatment arms.[10] Panel A contains student level variables, Panel B contains teacher level variables, Panel C are head teacher and school level variables, and Panel D are CS level variables. Columns 1 through 3 are the sample means and standard deviations for each treatment arm and column 4 provides the p-value for the test that the three arms are statistically equal. Across all means tested, none of the differences are statistically significant different.

[Table 1 about here]

A few statistics, which are statistically equal across all arms, are of note. Students were on average about 12 years old. Recall that these are students in grades 4 and 5 at baseline. If a student started grade 1 on time at age 6, then that student would be age 9 or 10 near the end of grade 4 and age 10 or 11 near the end of grade 5. Therefore, these students were substantially older, indicating either delayed entry or grade repetition, or both. About 53 percent of students, 74 percent of teachers, 80 percent of head teachers, and 90 percent of circuit supervisors were male. Teachers were about 31 years old, head teachers were about

[10]We use item response theory to put all tests on the same scale and standardize scores based on control group baseline mean and standard deviation.

42 years old, and circuit supervisors were 45 years old. Almost all teachers (91 percent) had a bachelor's degree or a diploma, and 28 percent of head teachers had received no pre-service or in-service training specifically about being a head teacher.

6 Results

6.1 Management

Both interventions improved management quality in the treatment schools. Table 2 contains these results. Relative to a control group management score standardized to mean 0 and standard deviation of 1, the two interventions increased the Instructional Management score by about 0.3SD, with a larger but statistically equivalent point value for the intervention that included enhanced management (column 1). Recall that the DI + basic management intervention was largely focused on Instructional Management. The effects of the interventions on the individual components of the Instructional Management Index appear in Appendix Table A1.

[Table 2 about here]

The enhanced management training focused on People Management. While the point values for both interventions are positive, the effect on People Management is only statistically significant for the intervention that included enhanced management (column 2). The intervention with enhanced management increased the people management index by 0.6SD. We reject the equality of the coefficients across the two interventions at the 0.01 level . The effects estimated separately for each component of the intervention appear in Appendix Table A2.

In the final column of Table 2 we test for the effects of the intervention on Other Management–aspects of management not directly targeted by either intervention but which could have improved as head teachers became more interested and engaged in their schools

and the school climate changed as documented in this sub-Section below. These aspects increased in both arms–about 0.4SD for the DI+basic intervention and 0.7SD for the DI+basic+enhanced intervention–with the effect of the intervention that included enhanced management statistically larger at the 10 percent level (p-value=0.06). Appendix A3 contains the estimates of the effect on each piece of the Other Management index separately.

One potential concern with these management findings is that head teachers and circuit supervisors learned from the training what was expected of them and told enumerators the expected behaviors but did not implement them. In Appendix Table A4 we divide the management indices into subordinate, e.g. what teachers said about head teachers, and self-reported measures. The findings are similar when re-estimated over only subordinate or only self-reported measures. As the teachers were subject to the same training in both interventions, any experimenter demand effect would not be differential by treatment status for those individuals. In the subordinate indices the statistically larger point value for the DI+Basic+Enhanced intervention relative to the DI+Basic intervention is confirmed.

6.2 School Operations

To test for changes in school operations we conducted two unannounced spot checks when schools were supposed to be holding normal school operations and DI lessons. Head teachers can only implement management changes when school is in session, they are present, and their teachers are present. We test for these outcomes in Table 3. Relative to a control group mean of 96%, the interventions increased the likelihood that school was in session by 3 percentage points (column 1). Head teachers cannot be effective leaders and teachers cannot be effective conveyors of knowledge if they are absent. Head teachers were 11 (DI+basic) or 15 (DI+basic+enhanced) percentage points more likely to be present relative to a control group mean of 42 percent (column 2). We do not find any effect on teacher attendance (column 3). On average only 62 percent of teachers across all three arms were present at

the start of our spot-check visits.[11] The additional enhanced management training did not differentially change any of the outcomes.

[Table 3 about here]

In addition to increasing the likelihood that schools were in session and head teachers were present, the interventions changed what was happening in the classrooms as shown in Table 4. Even though the interventions did not affect the likelihood that a teacher was physically present at school, they both increased the likelihood that a teacher was in the classroom by 13 (DI+Basic) and 11 (DI+Basic+Enhanced) percentage points (column 1).

The interventions provided materials, instruction on making materials, and training in and sample activities to encourage active learning. Teachers in treatment schools were more likely to be using teaching and learning materials–19 percentage points in the DI+Basic intervention and 13 percentage points in the DI+Basic+Enhanced intervention. Teachers were 17 (DI+Basic+Enhanced) and 21 (DI+Basic) percentage points more likely to be engaged with students and students were 16 (DI+Basic+Enhanced) or 18 (DI+Basic) percentage points more likely to actively participate in the observed lesson by either asking or answering a question. In all cases the point values are larger for the DI+Basic intervention and in one case we reject that the changes are statistically equivalent–teachers in the DI+Basic intervention were more likely to use materials than those in the DI+Basic+Enhanced intervention. In Column 5 we combine the measures in Columns 2 through 4 into a single Active Learning Index. This index increased by 0.47SD in DI+Basic and 0.36SD in DI+Basic+Enhanced. We reject that these values are equal.[12] Therefore, classrooms in DI+Basic schools appear to have become more active than those in DI+Basic+Enhanced and both have more active learning than in control schools. We discuss the potential source of and implications for this difference by treatment status more in Section 8.

[11] About half of this absenteeism appears to be chronic–being absent at the first spot check increased the likelihood of being absent at the second spot check by 15 percentage points ($p = 0.01$)–making it difficult to change.

[12] In Appendix Table A5 we re-esimate columns 2-5 for the classrooms that had a teacher present, finding similar results, including the statistically significant difference between DI+Basic and DI+Basic+Enhanced for both TLM Use and the Active Learning Index.

[Table 4 about here]

These observations occurred across the first two periods of the day, yet DI time was only one period long. The most common time for DI implementation was Period 1.[13] Therefore, teachers appear to be implementing active learning strategies outside of strictly DI periods. In Appendix Table A6 we estimate the outcomes in Table 4 separately by Period finding statistically significant positive effects of the interventions in all outcomes in each Period. The value on the Active Learning Index falls more for DI+Basic+Enhanced schools between the two Periods leading to statistically different point estimates for the two interventions in Period 2 (when schools were less likely to be doing DI) with a higher value for the DI+Basic intervention.

In addition to training in active pedagogy, DI implementation included dividing students by learning levels for one Period each day. To implement DI, teachers had to establish each student's learning level through a brief test, divide students by learning levels, and use the Teacher's Manual as a guide for lessons. The first four columns of Table 5 are teacher self-reported measures of implementation. Over 95 percent of teachers reported that they completed the leveling (column 1), about 90 percent reported that they did DI at least four days in the prior week (column 2), about 78 percent reported that they had done or were planning to do DI the day of the enumeration visit (column 3), and at our final visit of the year about 76 percent reported still having their copy of the DI manual, which contained the entire year's skeleton lesson plans (column 4). Teachers were marginally more likely (p-value=0.08) to have done the leveling in the DI+Basic+Enhanced arm (column 1). The other effects are statistically equivalent across the two treatments, but in all cases the point values are larger for the DI+Basic+Enhanced intervention.[14]

[13]About 43 percent of head teachers reported that their school implemented DI in Period 1, 35 percent in Period 2, and 22 percent at another time of day.

[14]We verified the teacher responses finding similarly strong responses from the head teachers about whether they verified that teachers completed the leveling correctly (with marginally stronger effects for the DI+Basic+Enhanced arm, p-value=0.09), the school did DI last week, and they still had their DI manual during our last visit. Head teachers also demonstrated their knowledge about DI and comfort with being able to explain the procedure to teachers. Results not presented.

[Table 5 about here]

The adherence to the differentiated instruction model is collaborated by observations–we observed about 58 (DI+Basic) or 62 (DI+Basic+Enhanced) percent of schools teaching their students by learning level instead of grade level during the at least one of first two periods of the day of our unannounced visits (column 5). This likely understates the true adherence as 22 percent of head teachers reporting that their school conducted DI lessons at times other than the first two periods of the day.[15] Column 6 combines these outcomes into a single index finding a positive effect of both interventions and a larger, but statistically equivalent, point value for the DI+Basic+Enhanced intervention.

The intervention further changed the climate of the school–making shirking less acceptable and increasing retention. We provided both teachers and head teachers vignettes in which a hypothetical student, teacher, head teacher, or circuit supervisor was shirking, e.g. managers not providing useful feedback or someone being chronically absent, and asked the respondents whether the behavior was acceptable. Table 6 contains these results, replacing the dependent variable in Equation 1 with an index over the vignettes about a specific agent. Treatment teachers judge shirking behavior by teachers more negatively by about 0.3SD (column 1). They judge shirking by all school agents, an index that combines responses about students, teachers, head teachers, and circuit supervisors, more negatively by 0.3SD (DI+Basic) or 0.4SD (DI+Basic+Enhanced) (column 2). Head teachers similarly view shirking by teachers more harshly–about 0.3SD (column 3). While the point values are negative on the overall index of head teachers' views, it is not statistically significant.[16]

[Table 6 about here]

[15]The training recommended implementing differentiated instruction in either of the first two periods of the day, on Tuesdays through Fridays, and starting the third week of the term. We timed our visits to match these guidelines. Some schools (22%) modified their exact implementation to suit the needs of their students by holding DI lessons as the last period of the day or just before or after the lunch break.

[16]Appendix Table A7 presents the opinions about other agents at the school separately–in almost all cases the point values are negative but not always statistically significant. Treatment teachers are statistically significantly less likely to accept shirking by hypothetical head teachers while we are unable to reject that treatment and control head teachers viewed shirking by their hypothetical head teacher peers similarly.

As both head teachers and teachers were exerting more effort, as measured by attendance (head teachers) and time in the classroom (teachers), and shirking behavior was being judged more harshly, we tested whether the interventions increased stress and burnout. These results appear in Appendix Table A8. The interventions at most marginally increased a composite index that includes questions on both stress and burnout. Teachers in the DI+basic+enhanced intervention had a 0.16SD higher value on this index ($p<0.10$) relative to a control group mean of 0 and standard deviation of 1. Both teachers and head teachers had positive statistically insignificant point values in the DI+Basic management intervention. The additional enhanced management did not change head teacher stress and burnout (coefficient = 0.000).

6.3 Student Achievement and Attrition

We estimate the effect of the program on student achievement using Equation 1 with a student's endline score as the dependent variable, including their baseline test score as an additional covariate. Table 7 contains these results. Students in either the DI+Basic or DI+Basic+Enhanced treatment increased their overall test scores by 0.11SD (column 1) with 0.13SD improvements in Math (column 2) and 0.07SD improvements in English (column 3).[17] Over this same period, control group students learned about 0.3SD, therefore, these test score increases are equivalent to about one third of a year of learning. In all cases we fail to reject the equality of the effect across the two arms and the point values are within 0.01SD of each other. Therefore, even though the quality of People Management differentially changed in the DI+Basic+Enhanced intervention, the test score improvements were almost identical across the DI+Basic and the DI+Basic+Enhanced interventions.

[17] Appendix Table A9 provides additional estimates of the effects on test scores. Panel A limits the controls to baseline test score and strata only finding similar estimates. Panels B-D estimate the effect on different subsets of questions: the foundational questions (i.e. those most similar to the ASER), the upper-level questions, and anchor questions that all students completed. We find statistically significant improvements across almost all types of questions with the exception of grade-level English scores increases that remain positive but are no longer statistically significant for the DI+basic+enhanced intervention. The largest point values are for the foundational questions.

[Table 7 about here]

As with any RCT, one concern is attrition at the follow-up generating selection into the test. To limit attrition we tracked all students not present in school at the start of the follow-up visit, eventually testing 96 percent of all baseline students. We tested 1.5 percentage points fewer students from the DI+Basic+Enhanced arm than the control group but this is not differential by both test score and treatment (Appendix Table A10). In Appendix Table A11 we provide Lee (2009) bounds accounting for this attrition. The point values are similar with the same statistical significance as those with the full sample.

We tested for heterogeneity in program impacts on student test scores by students' baseline test score, gender, grade level at baseline, parents' literacy, and a school amenity index, finding no heterogeneous effects (Appendix Table A12).[18] Appendix Figure A3 displays the non-parametic test results. While previous studies of remedial interventions found larger effects for students with the lowest baseline scores, our study as with other studies of Differentiated Instruction programs that tailored instruction to multiple learning levels did not (Banerjee et al. 2007; Banerjee et al. 2017; Duflo, Kiessel, and Lucas 2021).

An additional concern with interventions that divide students by learning level is that students might become discouraged if they are in the lowest learning level, increasing absenteeism, drop out, or a dislike of school. Students in the DI+Basic intervention were about 3 percentage points less likely to be present, but their schools were about 3 percentage points more likely to be open (and we could not check attendance in closed schools), therefore the net effect relative to the control group is approximately 0 (Appendix Table A13, column 1). We find the intervention decreased the likelihood that the student was still attending the study school according to the teacher or head teacher at the spot-check by about 2 percentage

[18]We tested for heterogeneity by test score as students who were the most behind grade level might have benefited more, by gender because of evidence from Ghana that head teachers are systematically biased against female teachers (Beg, Fitzpatrick, and Lucas 2021) and therefore might also exhibit bias towards female students, by student grade level as students at different places in their scholastic journeys might have had different experiences, by parent literacy as a proxy for whether the student was a first generation learner and could get help at home if needed, and finally by school amenities in case the intervention was particularly well suited for schools with different levels of existing resources.

points (Appendix Table A13, column 2). This will be the sum of students changing schools and those no longer attending any school. Among the students we reached, we find no difference in the likelihood that the student stated he was still enrolled in a school (Appendix Table A13, column 3). As an additional measure of potential disillusionment, we test what students thought of math and English, the subjects that were focus of the intervention and their aspirations for future study with the results in Table A14. Students did not change the likelihood that their favorite subject was either math or English (control group mean of 79 percent). The point value is positive for DI+Basic and negative for DI+Basic+Enhanced, and we can reject equality between the two intervention arms (p-value=0.02). Students in the DI+Basic intervention were 5 percentage points more likely than students in the control schools to say that they liked English or math "very much" (control group mean of 79 percent), statistically larger than the DI+Basic+Enhanced value. The intervention did not change the likelihood that students aspired to graduate from (non-compulsory) senior high school (control group mean of 97 percent).

6.4 Persistent Effects

In this subsection we provide evidence that the effects of the intervention persisted into the year following the intervention. At the conclusion of the main intervention year, head teachers and teachers were instructed to continue with the intervention but they received no additional materials. GES invited one teacher from each school to a brief refresher training prior to the start of the subsequent school year. We planned two data collection exercises for this post-intervention year–a spot-check during Term 2 (February-April 2020) and a full follow-up, including management questions, during Term 3 (May-July 2020). The spot-check was truncated due to Covid-19 and the full follow-up did not happen.

From the data we collected during the post-intervention year, we have three measures of management quality–teacher and head teacher retention and a single Management index. In Table 8 we test the effect of the interventions on these outcomes. In the control group about

59 percent of teachers from Term 1 of the intervention year were still teaching in the same school. The interventions increased the likelihood that a teacher was still in the school by 18 (DI+Basic) and 8 (DI+Basic+Enhanced) percentage points, 30 and 14 percent increases relative to the control mean (column 1). We reject equality across the two interventions. Teacher retention has two components–does the teacher want to stay and does the head teacher want the teacher to stay.[19] The increase across both treatments could reflect the more supportive work environment–across both arms teachers indicated that head teachers were more likely to provide useful feedback and mention something that teachers were going well as part of that feedback (Table A2)–and satisfaction with seeing that students were learning that was reflected in the qualitative follow-up. Teachers did report higher levels of stress and burnout in the DI+Basic+Enhanced intervention and head teachers might have been more likely to encourage less effective teachers to leave the school in that intervention, potentially leading to less retention in the DI+Basic+Enhanced intervention. Neither intervention statistically significantly increased the likelihood that the head teacher was still the head teacher of the school in the year after the intervention.

[Table 8 about here]

In column 3 of Table 8 we combine the available management questions into a single management index, finding that management quality persisted–school management was 0.26SD (DI+Basic) and 0.38SD (DI+Basic+Enhanced) higher in the treatment schools.[20] We attempted to observe classes in all study schools but had to stop fieldwork after reaching only 60 percent of schools. Based on this truncated round, about 40 percent of schools were still dividing their students by learning levels for one of the first two periods of the day (Table 8, column 4).

[19]Neither actor has complete autonomy over the decision as all transfer requests go through Ghana Education Services.

[20]In this truncated round the treatment did not statistically significant change student attendance or on-time progression. Students who were P4 at baseline and should have been in P6 at this follow-up were 4 percentage points (DIB) and 5 percentage points (DIBE) less likely than students in control schools to be enrolled in the study school. As we asked the enrollment questions of teachers and head teachers this may reflect that the teachers and head teachers were more aware of their students due to the intervention as the attendance levels were not different by treatment status.

7 Cost Effectiveness

We use the ingredients method to assess cost effectiveness. For the one year intervention on which the achievement results are based, the DI+Basic Management intervention cost $41 per student and the DI+Basic+Enhanced Management cost $74 per student. As the achievement effect sizes were approximately the same across the two interventions, the DI+Basic Management intervention was clearly more cost effective. To scale this relative to the effect size per $100, this would be 0.26SD per $100 for DI+Basic Management and 0.14SD per $100 for DI+Basic+Enhanced Management. To scale this as a price per year of learning in this context, DI+Basic Management costs $125 per student per year of learning and DI+Basic+Enhanced costs $228 per student per year of learning.[21] Any achievement effects in the second year due to schools continuing to implement the program with minimal training of one teacher and no additional materials will increase the cost effectiveness. Unfortunately, we were unable to collect achievement data in the year after the intervention.

8 Discussion

We find that the two interventions equally improved Instructional Management but the DI+Basic+Enhanced intervention differentially improved both People Management and Other Management. When considering what was actually happening in the classroom, Active Learning improved more in DI+Basic intervention while DI Implementation was suggestively stronger in the DI+Basic+Enhanced intervention. Student learning increased equally across the two interventions.

Comparing either intervention relative to the control group and previous findings on similar teacher training alone in both Ghana (Duflo, Kiessel, and Lucas 2021) and India (Banerjee et al. 2017) shows that augmenting teacher training with management support increases student learnning. Further comparing either treatment to the control group and

[21]Both of these scaling methods make assumptions about the linearity of returns. We provide them to allow readers to compare this study's cost effectiveness to other studies.

previous findings in Argentina (Ganimian 2020) and India (Muralidharan and Singh 2021) on management training alone shows the complementarity between management and teacher training.

The statistically equivalent and almost identical point values in learning increases between the two treatment arms is consistent with two potentially simultaneously occurring phenomena. First, Instructional Management could be more important for student learning than People or Other Management–school meetings, CS visits (independent of classroom observations), and whether teachers consider their managers good mentors are less important in the education production function than providing classroom observations and accompanying feedback. Based on a mediation analysis, schools with larger Instructional Management increases also had larger test score gains (Appendix Figure A5). In contrast, the relationship between increased People Management increases and test scores is flat–schools with larger gains in People Management had the same test score increases as those with smaller gains in People Management. Second, the enhanced management caused head teachers to focus more on other aspects of management and less on whether active learning was happening in the classroom. As measured by attendance, HTs in the two arms appear to increase effort the same amount, but spread over more things–meetings, etc–in the arm that included enhanced management training.

This suggests that the simple rule of thumb observation form and encouragement to use it caused head teachers to focus more on instructional improvement and the additional, enhanced management training may have distracted them from this goal.

9 Conclusions

Despite a recognition in the last 20 years of the importance of management for private sector productivity, much less work has been done on the importance of management for public sector service delivery. As a proof of concept, we showed that management quality in Ghanaian schools is associated with higher student test scores as has been shown in 7

other countries. Further, we implemented a 210 school, 3 arm randomized controlled trial in partnership with the Ministry of Education of Ghana to test the importance of management in public service delivery. We find that even though the treatment with additional enhanced management training improved management more than a more basic management intervention, both classroom activities and student achievement improved equally across the two interventions. The two interventions increased student test scores by 0.11 SD, about one third of a year of learning in this context. Despite only minimal training of one teacher the year after the end of the main intervention, we still observed compliance with differentiated instruction at a level that was 70 percent of the level during the initial supported year.

Management is likely a key component to increase student learning at scale. We show the complementarity between a teacher training and a supervisor checklist that supported improvement in Instructional Management in improving student learning.

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A Appendix

A.1 Additional Intervention Details

Teacher Material Development

Since the success of a program at scale depends on government systems supporting and sustaining the intervention, this intervention involved all relevant government agencies from the inception–Ghana Education Services (GES) and its subsidiaries including the Basic Education Division (BED), National Council for Curriculum and Assessment (NaCCA), and the National Inspectorate Board (NIB). This intervention consisted of materials, personnel, and training, all of which was implemented exclusively through the existing government system with the exception of one person who monitored the help-desk who was a UNICEF intern.

The National Council for Curriculum and Assessment (NaCCA), the board responsible for managing and implementing government curriculum policy, led the development of DI materials. A NaCCA Resource Development Team conducted an initial review of existing GES materials and materials used in the previous implementation of targeted instruction in Ghana, the Teacher Community Assistant Initiative (TCAI), which targeted students in grades 1 through 3. They then modified these existing resources and designed and developed new materials as appropriate for older learners. The teaching materials included topics to cover each day, and ideas for class, group, and individual activities. These were not scripted lessons, leaving teachers the latitude to pick the activities that most resonated with their students.

A core team of the National Teaching Council (NTC), the council responsible for licensing teachers in Ghana, developed the training materials and facilitator manuals.

Teacher Training

Teacher training was a cascade model. NTC trained 24 national trainers. The national trainers trained 160 District Teacher Support Team (DTST) members, i.e. district-level government employees regularly responsible for in-service teacher training. These DTST

members trained the treatment teachers, head teachers, and circuit supervisors. The training included time to practice differentiated instruction with other training participants.

The main teacher training occurred for 5 days prior to the start of the 2018-2019 academic year with shorter refresher trainings prior to the start of each term, 3 day at the start of term 2 and 2 days at the start of term 3.

Enhanced Management Material Development

The National Inspectorate Board (NIB), the board that oversees school inspection and evaluation, developed the circuit supervisors' and head teachers' management intervention materials including the their manuals, quick reference cards, and content for text message reminders. Much of the content was a condensed version of the existing manual for head teachers and circuit supervisors, *Leadership for Learning.* The management manuals were not limited to DI content, instead reminding head teachers and circuit supervisors how to be effective school leaders and support teachers, broadly. The training focused on guidelines for productive classroom observations, including providing helpful feedback.

Enhanced Management Training

The management training lasted occurred after the teacher training prior to the start of the 2018-2019 academic year. The initial training was 3 days with 2 days of refresher training prior to the start of Term 2, and a 1 day refresher training prior to the start of Term 3.

Implementation

The training suggested that schools implement DI during the first period of the day. Schools could implement it at a time that worked best for them–43 percent selected Period 1, 33 percent Period 2, and 22 percent another time of day.

In the first two terms the teaching observation forms were completed on paper. In term 3, these forms were completed on a tablet through the mobile School Report Card (mSRC) system that all head teachers, both treatment and control, had.

A.2 Test Construction

We designed the test to include both foundational concepts and grade level content. The majority of questions were adapted from the examinations used in Duflo, Kiessel, and Lucas (2020), which had been originally developed by education stakeholders in the Ministry of Education to reflect grade 1 through grade 4 material. Based on piloting and findings from Duflo, Kiessel, and Lucas (2020), many students in grade 4 and 5, our target grades, still tested at that level. We added additional questions that were inspired by questions from the Ghana National Education Assessment grade 3 and 6 exams. Enumerators conducted the assessments one-on-one. Based on piloting, the grade level of the source of the assessments, and data from Duflo, Kiessel, and Lucas (2020), the exam questions were divided into three difficulty levels: easier, medium, and harder. In consideration of student and enumerator time, not all students were asked all questions. The tests were semi-adaptive: all students started with the medium questions, then progressed to either the easier or harder questions based on their performance. As all students completed the same anchor (medium) questions, we used item response theory to put all scores on a common scale. Teachers did not see the exams nor did students retain any papers that they could have shared with their teachers. These were not the same exams that teachers used to level students. Appendix Figure A1 contains the test score distribution at baseline.

[Appendix Figure A1 about here]

A.3 Management Index Construction

[needs to be updated from table A1, 2, 3]

Instructional Management:

Headteacher reported: (1) Conducted a 5-minute classroom observation in previous term for P4-P6 teachers, (2) Conducted a 30-minute classroom observation in previous term for P4-P6 teachers, (3) Conducts classroom observations of all teachers frequently. (4) CS observed classroom teaching at least once per term. (5) Pupil scores are used for promotion

(6) Teachers use lesson plans everyday (7) Teachers pay attention to individual student needs in their classroom.

School-wise average of teacher reported variables: (1) HT/CS conducted a 5-minute classroom observation in previous term. (2) HT/CS gave feedback after observation. (3) HT/CS conducted a 30-minute classroom observation in previous term.

People Management:

Headteacher reported: (1) Provides suggestions to teachers for improving their teaching (2) Takes the initiative to discuss matters when a teacher has problems in the classroom (3) Provides constructive feedback to teachers in school. (4) held staff meetings with all teachers (5) Agrees CS is (i) good mentor (ii) good manager (iii) provides valuable work (iv) works with HT to solve problems (6) CS visited the school at least twice per term. (7) CS conducted at least two meetings per term with the head teacher.

School-wise average of teacher reported variables: (1) HT held at least two staff meetings per term with all teachers. (3) HT/CS provided useful feedback after classroom observation. (4) HT/CS feedback included praise. (5) HT/CS feedback included suggestions for improvement. (6) Teacher strongly agrees that (i) she/he is valued and appreciated (ii) HT/CS have helped him/her become a better teacher (iii) HT is a good manager

Other Management: (1) Ensures teacher skills are always improving, (2) Ensures that teachers are held accountable for the attainment of the school's goals, (3) Encourage teachers to try new teaching practices e.g. based on teacher trainings. (4) Had meetings with parents. (5) Teachers receive rewards for good performance, (6) School had records for student attendance, (7) School had records for teacher attendance, (8) Teachers encourage students to approach them outside class for supplemental help if students are facing difficulty in learning in class, (9) The school uses student's scores to establish the teachers' effectiveness, (10) The school uses teacher's feedback to guide goals and development plans, (11) Teachers share new teaching practices with other teachers in the school. (12) HT present.

Appendix Figure 2 shows the correlation between each of these indices and student test

scores.

[Appendix Figure 2 about here]

A.4 Additional Results

Tables A1 through A3 contain the effect of the interventions on each component of the management indices.

[Appendix Table A1 about here]

[Appendix Table A2 about here]

[Appendix Table A3 about here]

Table A4 shows the effect of the intervention on classroom activities conditional on teachers being present.

[Appendix Table A4 about here]

Table A5 confirms the implementation of DI based on survey responses by the head teachers.

[Appendix Table A5 about here]

Table A6 reports the effects of the intervention on teacher and head teacher work stress and burnout.

[Appendix Table A6 about here]

Table A7 divides the test into foundational (Panel A) and upper level questions (Panel B).

[Appendix Table A7 about here]

Table A8 provides effects only on the test questions common to all students.

[Appendix Table A8 about here]

Table A9 tests whether the treatment made students more or less likely to appear in the achievement endline.

[Appendix Table A9 about here]

Despite finding at most minimal differential selection, and not by treatment and baseline test score, we provide Lee (2009) bounds in Table A10.

[Appendix Table A10 about here]

Table A11 provides tests for heterogeneous treatment effects by baseline test score, student gender, being a P4 student in the year prior to the intervention (instead of P5), and whether either parent was literate, finding no statistically significant differential effects.

[Appendix Table A11 about here]

Table A12 shows that students were marginally less likely to be present the day of a spot check (column 1) and were equally likely to say that they still attended the study school (column 2).

[Appendix Table A12 about here]

Table A13 shows that the program did not cause students to become disillusioned about school.

[Appendix Table A13 about here]

Figure 1: Randomization Design

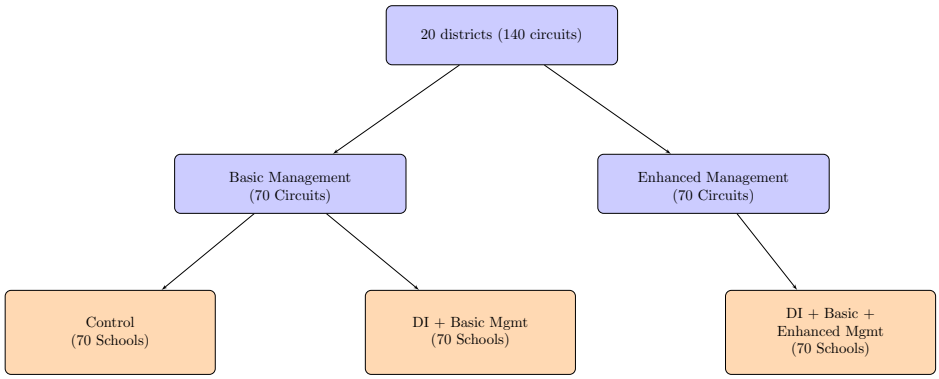


Figure 2: Timeline of Study Activities

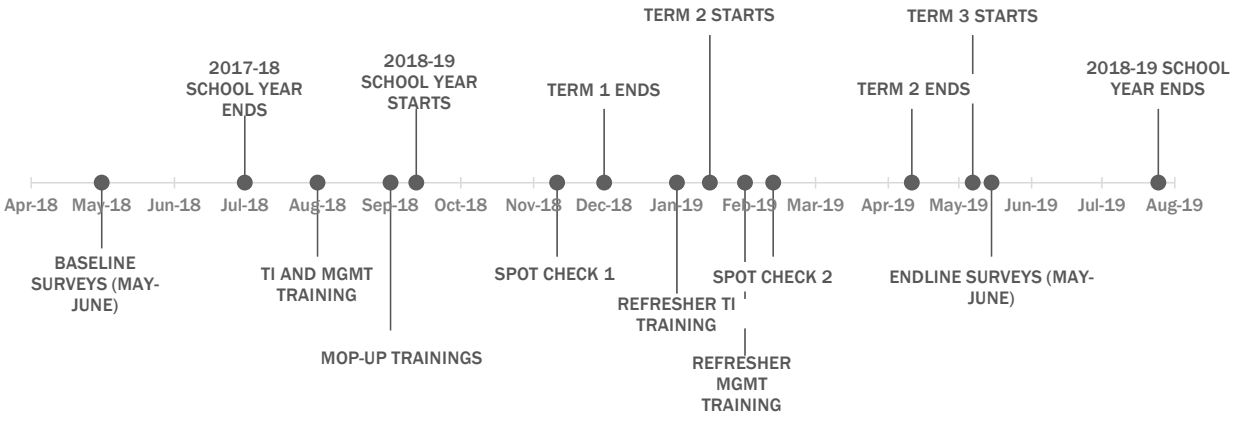


Table 1: Summary Statistics

	—Control—	DI+Basic Mgmt	DI+Basic+ Enh Mgmt	Joint P-Value
Panel A: Student-Level Variables	(1)	(2)	(3)	(4)
Male	0.53	0.54	0.53	0.83
	(0.50)	(0.50)	(0.50)	
P4 student	0.50	0.51	0.50	0.14
	(0.50)	(0.50)	(0.50)	
Age	12.17	12.05	12.12	0.62
	(1.77)	(1.88)	(1.83)	
Baseline Math	0.01	-0.02	0.01	0.84
	(0.99)	(0.99)	(1.02)	
Baseline English	-0.00	0.00	0.00	1.00
	(0.97)	(1.01)	(1.00)	
Baseline Composite Score	0.00	-0.01	0.01	0.97
	(0.98)	(1.00)	(1.02)	
N	2031	1932	1930	
Panel B: Teacher-Level Variables				
Male	0.74	0.75	0.73	0.94
	(0.44)	(0.44)	(0.46)	
Age	31.64	31.57	30.96	0.18
	(6.90)	(7.38)	(6.05)	
Years Experience as a Teacher	6.17	6.13	5.95	0.63
	(5.97)	(6.10)	(5.44)	
Teacher Present at Arrival	0.84	0.86	0.89	0.68
	(0.36)	(0.35)	(0.31)	
# HT Class Observations (Term 1 and 2)	9.03	8.81	8.04	0.86
	(15.11)	(12.57)	(12.93)	
HT Gives Feedback About Teaching	0.74	0.77	0.79	0.56
	(0.44)	(0.42)	(0.41)	
N	217	226	228	
Panel C: Head Teacher and School-Level Variables				
Male	0.81	0.86	0.86	0.73
	(0.39)	(0.35)	(0.35)	
Age	42.90	40.67	42.84	0.19
	(8.84)	(8.18)	(9.54)	
Years Experience as HT	6.81	6.03	7.64	0.15
	(5.93)	(4.90)	(5.94)	
School Enrollment P4-P5	71.83	80.69	74.46	0.30
	(32.35)	(48.18)	(50.57)	
N	70	70	69	
Panel D: CS-Level Variables				
Male		0.92	0.89	0.43
	–	(0.27)	(0.31)	
Age		45.93	44.36	0.19
	–	(6.37)	(7.80)	
Number of Schools in Circuit	–	8.36	8.40	0.93
	–	(2.71)	(2.33)	
Years Experience as CS	–	3.72	3.52	0.55
		(3.09)	(3.18)	
N	–	70	70	

Notes: Each cell presents the mean, with standard deviations in parentheses, of variables from the baseline survey. One head teacher declined the baseline survey. Column 4 presents the p-value on the F-test of joint equality for columns 1−3, controlling for strata (district) and using standard errors clustered at the school level. $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table 2: Management Outcomes Indices

Index:	**Instructional Management** (1)	**People Management** (2)	**All Other Management** (3)
DI + Basic Mgmt	0.284**	0.198	0.368**
	(0.141)	(0.158)	(0.143)
DI + Basic + Enhanced Mgmt	0.362***	0.637***	0.650***
	(0.127)	(0.154)	(0.166)
Observations	210	210	210
R^2	0.24	0.34	0.21
Mean Dep., Control	0.00	-0.00	0.00
P-Value Same Effect	0.43	0.01	0.06

Notes: The outcome variables are standardized indices of management outcomes. All regressions include baseline management index and district fixed effects.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 3: Attendance at Unannounced Spot Checks

Attendance:	**School in Session** (1)	**Head Teachers** (2)	**Teachers** (3)
DI + Basic Mgmt	0.029*	0.111*	0.042
	(0.016)	(0.064)	(0.037)
DI + Basic + Enhanced Mgmt	0.028*	0.148**	0.028
	(0.016)	(0.064)	(0.042)
Observations	420	419	1,175
R^2	0.07	0.14	0.09
Mean Dep., Control	0.96	0.42	0.62
P-Value Same Effect	0.93	0.57	0.73

Notes: Regressions include district and survey round fixed effects. Standard errors clustered at the school level appear in parenthesis. Column 1: An indicator for whether or not students were having classes the day of the unannounced spot check. Columns 2 and 3: Additional covariates: respondent baseline attendance, age, gender, experience, age squared, and experience squared. Column 2: Indicators for whether a head teacher was present in school at the start of the unannounced spot checks. Column 3: Indicators for whether a teacher was present in school at the start of the unannounced spot checks. Additional covariate: Grade level taught.

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

Table 4: Changes in Classroom Activities

Dependent Variable:	**Teacher in Classroom**	**Any TLM Use**	**Engaged Teacher**	**Engaged Student**	**Active Learning Index**
	(1)	(2)	(3)	(4)	(5)
DI + Basic Mgmt	0.130***	0.192***	0.206***	0.180***	0.470***
	(0.032)	(0.032)	(0.025)	(0.029)	(0.060)
DI + Basic + Enhanced Mgmt	0.111***	0.126***	0.172***	0.163***	0.362***
	(0.034)	(0.032)	(0.026)	(0.029)	(0.059)
Observations	2,462	2,462	2,462	2,462	2,462
R^2	0.07	0.08	0.10	0.08	0.10
Mean Dep., Control	0.68	0.48	0.46	0.48	0.00
P-Value Same Effect	0.51	0.03	0.21	0.52	0.06

Notes: Unit of observation: class period by survey round. Regressions include whether the observation is from the first or second spot check, whether the observation is from the first or second class period observed, the average percent of teachers present during the baseline survey, and strata (district) fixed effects. Standard errors clustered at the school level appear in parenthesis. Linear probability models. Column 1: Whether the teacher was present during the entire classroom observation. Column 2: Whether teaching and learning materials were being used in the classroom. Column 3: Whether the teacher was engaged with their students. Absent teachers are considered "not engaged." Column 4: Whether a student was able to express their own idea during the classroom observation.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 5: Teacher DI Implementation

Dependent Var:	**Did Leveling** (1)	**DI Last Week** (2)	**DI Today** (3)	**Owns DI Manual** (4)	**Class In Levels** (5)	**DI Imp Index** (6)
DI+Basic Mgmt	0.957***	0.898***	0.779***	0.759***	0.582***	0.509***
	(0.012)	(0.021)	(0.029)	(0.034)	(0.047)	(0.125)
DI+Basic+Enhanced Mgmt	0.983***	0.935***	0.792***	0.774***	0.615***	0.533***
	(0.010)	(0.017)	(0.029)	(0.036)	(0.046)	(0.122)
Observations	1,126	1,126	1,126	590	412	210
R^2	0.91	0.79	0.57	0.57	0.44	0.23
P-Value Same Effect	0.08	0.14	0.74	0.74	0.57	0.88

Notes: Regressions include teacher age, gender, experience, age squared and experience squared, and district and survey round fixed effects. Standard errors clustered at the school level appear in parenthesis. No control teachers undertook any of these actions, therefore the values are 0 for control schools. Column 1: Whether the teacher self-reported conducting the leveling exam. Column 2: Whether the teacher reported having split students by levels instead of by class at least 4 times in the past week. Column 3: Whether the teacher reported doing DI or planning to do DI that day. Column 4: Whether the teacher reported at the endline still owning the DI manual. Column 5: Whether the class was split by levels during the unannounced spot checks. Column 6: An index of DI implementation, at the school level.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 6: Norms of Acceptable Behavior

	Teacher Opinions of Teachers (1)	**Teacher Opinions of All Roles (Index)** (2)	**HT Opinions of Teachers** (3)	**HT Opinions of All Roles (Index)** (4)
DI + Basic Mgmt	-0.261**	-0.310***	-0.251*	-0.038
	(0.108)	(0.105)	(0.152)	(0.153)
DI + Basic + Enhanced Mgmt	-0.354***	-0.401***	-0.301**	-0.206
	(0.107)	(0.118)	(0.142)	(0.156)
Observations	461	461	209	209
R^2	0.28	0.28	0.26	0.28
Mean Dep., Control	-0.00	0.00	-0.00	-0.00
P-Value Same Effect	0.36	0.40	0.74	0.28

Notes: Respondents were asked at endline questions regarding whether or not a particular action by a hypothetical person (student, teacher, head teacher, circuit supervisor) was acceptable or not. Sample of teachers is restricted to those from baseline. Indices of questions about hypothetical people in a particular role, grouped by respondent type, standardized by control group mean and standard deviation. Regressions include respondent age, gender, experience, age squared and experience squared, and district and survey round fixed effects. Standard errors clustered at the school level appear in parentheses. Column 1: Index of assessments of hypothetical teachers by teachers. Column 2: Index combining all teacher responses. Column 3: Index of assessments of hypothetical teachers by head teachers. Column 4: Index over all vignettes reported by head teachers.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 7: Student Test Scores

	Combined Score (1)	**Math Score** (2)	**English Score** (3)
DI + Basic Mgmt	0.108***	0.140***	0.065***
	(0.021)	(0.026)	(0.022)
DI + Basic + Enhanced Mgmt	0.107***	0.131***	0.076***
	(0.024)	(0.029)	(0.024)
Observations	5,608	5,608	5,608
R^2	0.74	0.63	0.71
Mean Dep., Control	0.33	0.32	0.30
P-Value Same Effect	0.95	0.75	0.63

Notes: Regressions include controls for student age, age-squared, grade at baseline, baseline assessment scores, female, and strata (district) fixed effects. Standard errors clustered at the school level appear in parenthesis. Scores standardized relative to the baseline pooled sample.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 8: Outcomes in Year After Implementation

	Teacher Retention (1)	**HT Retention** (2)	**SC3 Index of Mgmt** (3)	**Class in Levels** (4)
DI + Basic Mgmt	0.178***	0.065	0.263**	0.416***
	(0.046)	(0.081)	(0.131)	(0.072)
DI + Basic + Enhanced Mgmt	0.083*	0.082	0.382***	0.448***
	(0.050)	(0.084)	(0.129)	(0.091)
Observations	687	208	208	127
R^2	0.18	0.09	0.56	0.39
Mean Dep., Control	0.59	0.59	0.00	0.00
P-Value Same Effect	0.03	0.84	0.42	0.77

Notes: Data collected during an unannounced spot check in Term 2 of the year after the intervention. Not all schools were reached due to Covid-19 related cessation of fieldwork. Linear probability models. Regressions include district fixed effects, with standard errors clustered at the school level. Column 1: whether or not a teacher from the first unannounced spot check in the year of the intervention was still working at the school as of the unannounced spot check during Term 2 of the year after the intervention. Column 2: Whether the head teacher from the evaluation year was still the head teacher of the same school during Term 2 of the year after the intervention. Column 3: whether students were divided into levels. Column 4: Swindex of all available management variables. All regressions include strata (district) fixed effects. Standard errors clustered at the school level appear in parenthesis.

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

Appendix Figures

Figure A1: Distribution of Student Test Scores at Baseline

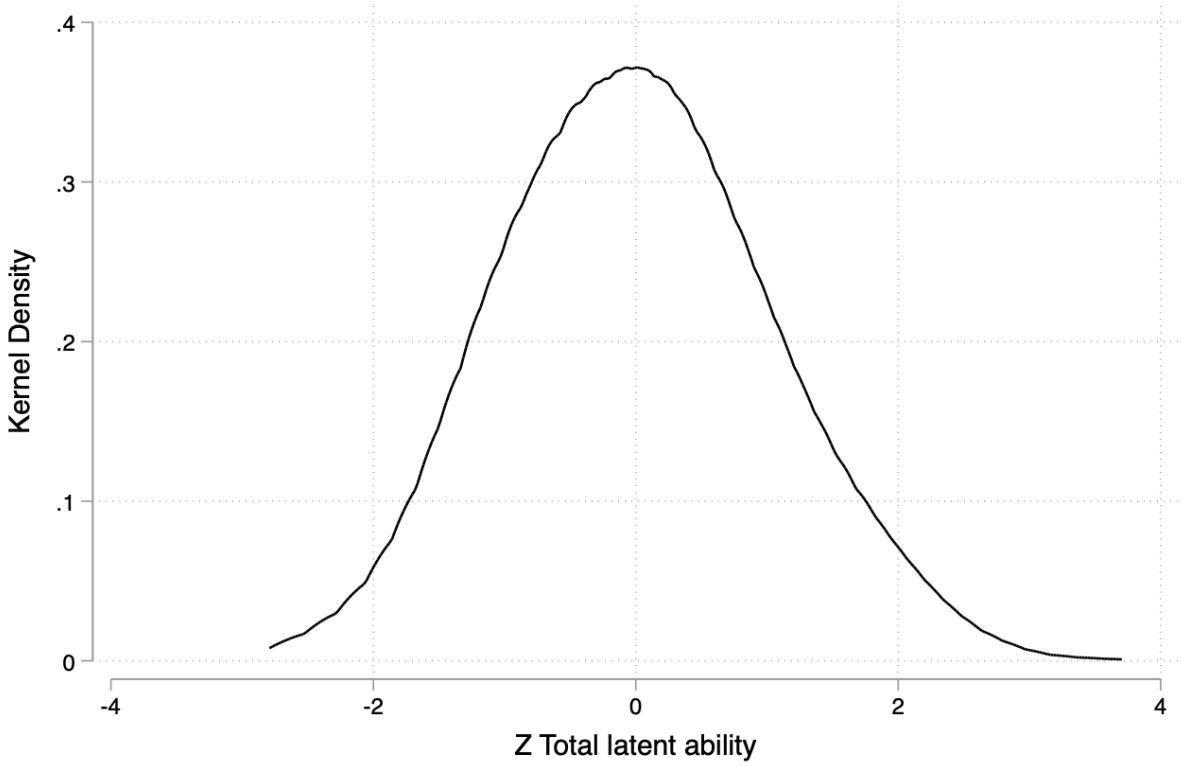


Figure A2: Correlation Between Management and Student Test Scores

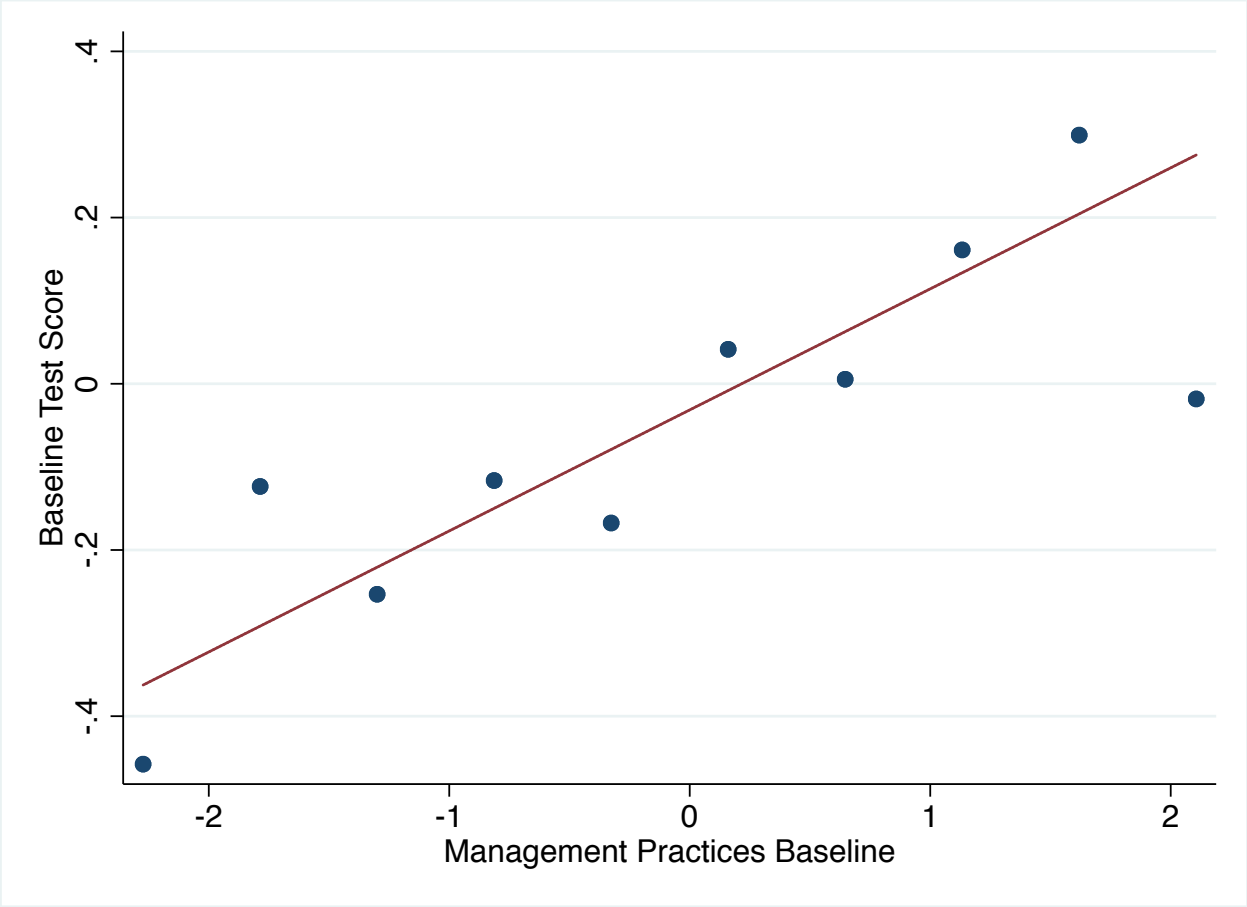


Figure A3: Non-Parametric Test Results

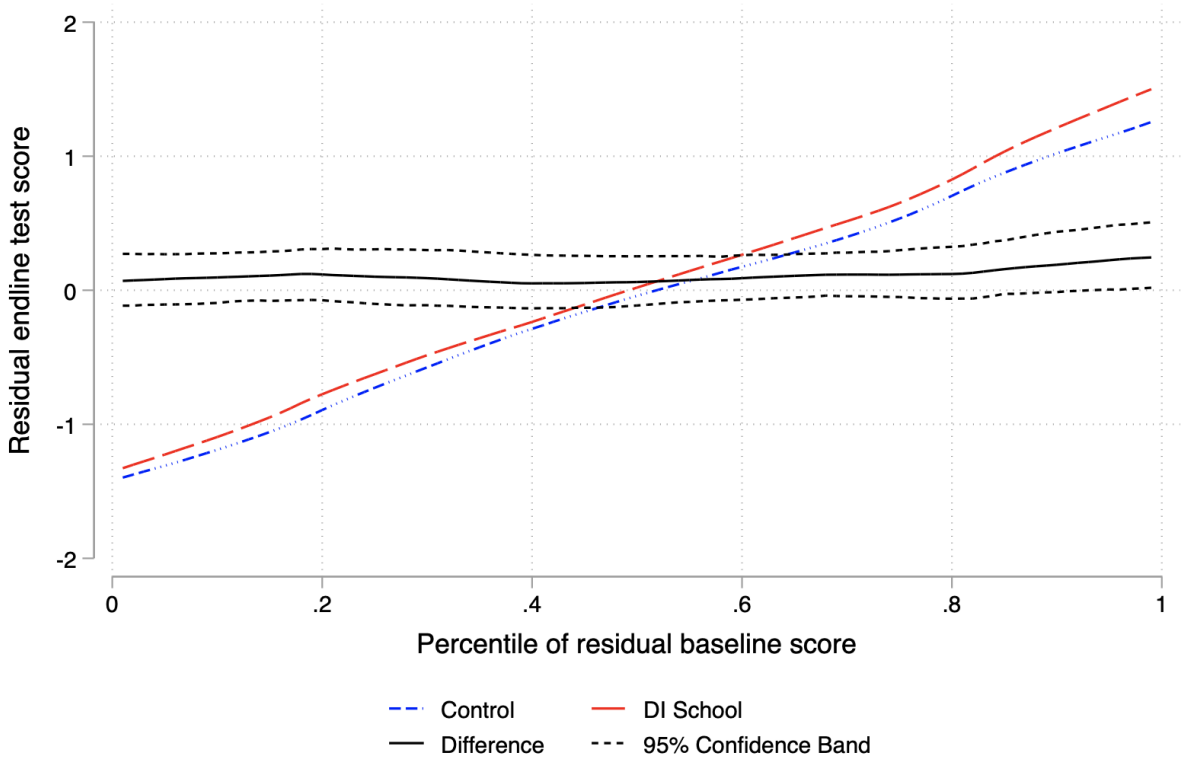
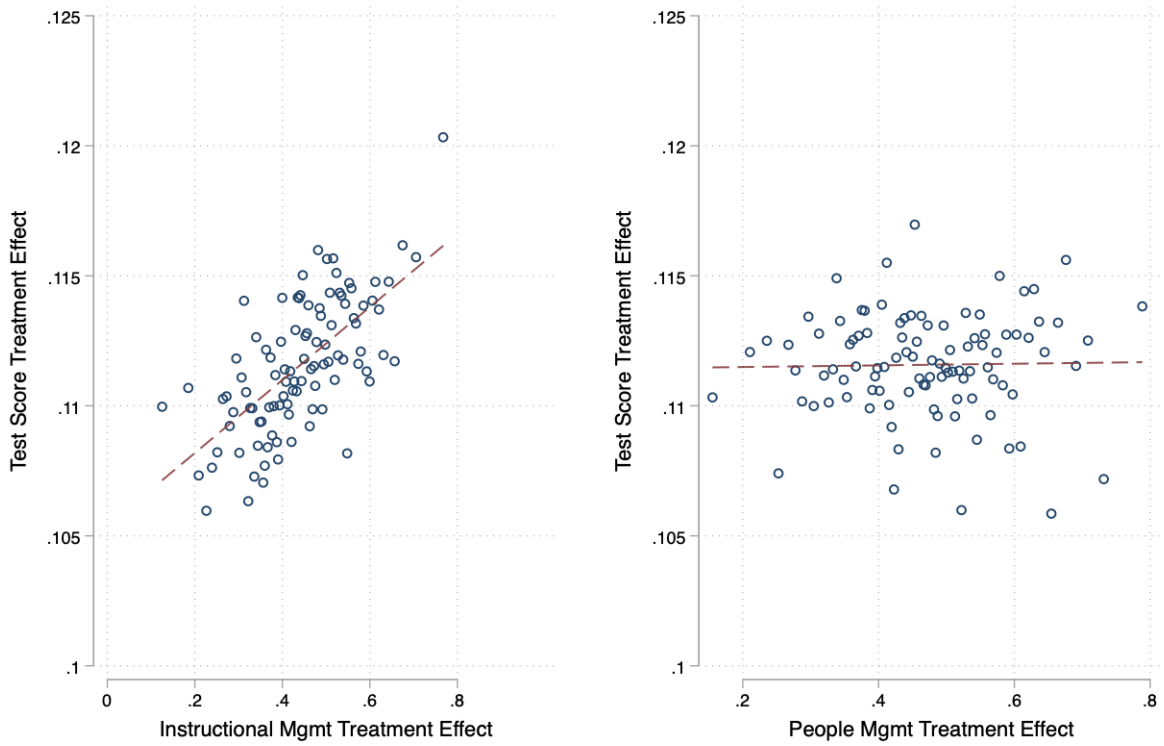


Figure A4: Mediation Analysis: Correlation of Management and Test Score Treatment Effects



Appendix Tables

Table A1: Individual Components of Instructional Management Index

	DI +Basic (1)	**DI +Basic +Enhd** (2)	**p-value** (3)	**Mean for Control** ' (4)
Average Number of P4-P6 Classroom Obsevations (5 min) by HT (HT)	0.266	-0.629	0.015	3.299
	(0.492)	(0.421)		
Pupils test scores are used to inform promotion (HT)	0.253***	0.232**	0.820	4.286
	(0.098)	(0.091)		
How often P4-P6 teachers use lesson plans (HT)	0.029	0.125	0.146	3.829
	(0.097)	(0.083)		
Number CS classroom observations (HT)	1.785***	2.796***	0.051	2.171
	(0.424)	(0.432)		
Teachers pay attention to indvidual student needs (HT)	0.128	0.031	0.250	4.114
	(0.110)	(0.114)		
HT Classroom Observations (5 min) (T)	0.596	0.064	0.121	3.284
	(0.390)	(0.317)		
CS Classroom Observations (5 min) (T)	0.616***	0.712***	0.449	0.779
	(0.111)	(0.128)		
HT Classroom Observation Feedback (T)	0.174***	0.215***	0.218	0.591
	(0.037)	(0.036)		
CS Classroom Observation Feedback (T)	0.280***	0.318***	0.328	0.305
	(0.036)	(0.036)		
Average Number of P4-P6 Classroom Obsevations (30 min) by HT (HT)	0.950***	0.806***	0.470	0.849
	(0.192)	(0.203)		
How often does HT observe teaching in school (HT)	0.160	0.264**	0.408	3.371
	(0.133)	(0.128)		
HT Classroom Observations (30 min) (T)	0.709***	0.899***	0.212	0.725
	(0.142)	(0.124)		
CS Classroom Observations (30 min) (T)	0.459***	0.671***	0.019	0.206
	(0.074)	(0.083)		
Number of CS Classroom Obsevations (5 min) in study schools (CS)	-0.003	1.038***	0.000	2.412
	(0.180)	(0.222)		
Number of CS Classroom Obsevations (30 min) in study schools (CS)	-0.014	1.966***	0.000	3.539
	(0.329)	(0.422)		
CS Classroom Obsevations Frequency (5 min) (CS)	0.007	0.268*	0.060	2.985
	(0.132)	(0.139)		
CS Classroom Obsevations (30 min) Frequency (CS)	0.005	0.075	0.620	2.909
	(0.124)	(0.141)		

Table A2: Individual Components of People Management Index

	DI +Basic (1)	DI +Basic +Enhd (2)	p-value (3)	Mean for Control ' (4)
HT provides constructive feedback (HT)	0.079	0.067	0.886	4.471
	(0.081)	(0.088)		
How often HT gives Ts suggestions about improving teaching (HT)	-0.021	-0.044	0.820	3.686
	(0.100)	(0.106)		
How often HT takes initiative to discuss matters with Ts (HT)	0.043	-0.015	0.609	3.551
	(0.110)	(0.112)		
Number of staff meetings each term by HT (HT)	-0.145	0.304**	0.004	2.407
	(0.133)	(0.144)		
Number of school visits by CS (HT)	1.564**	2.116***	0.479	5.971
	(0.695)	(0.720)		
Number of HT meetings with CS (HT)	-0.105	0.982*	0.107	4.217
	(0.561)	(0.579)		
CS is a valuable mentor (HT)	0.077	0.196*	0.252	4.386
	(0.097)	(0.103)		
CS works with HT to solves problems (HT)	0.091	0.149	0.544	4.414
	(0.107)	(0.106)		
CS performs valuable work for school (HT)	0.081	0.193*	0.291	4.286
	(0.100)	(0.105)		
CS is a good manager (HT)	0.033	0.109	0.525	4.257
	(0.106)	(0.100)		
Number of staff meetings by HT (T)	-0.039	0.745**	0.029	4.695
	(0.331)	(0.329)		
Number of staff meetings by CS (T)	0.048	0.306	0.337	2.060
	(0.230)	(0.284)		
CS provides useful feedback (T)	0.246***	0.290***	0.272	0.263
	(0.034)	(0.037)		
HT provides useful feedback HT (T)	0.168***	0.184***	0.659	0.519
	(0.038)	(0.038)		
HT feedback mentions something T did well (T)	0.186***	0.230***	0.431	0.536
	(0.055)	(0.054)		
HT feedback offers sugg. for improvement (T)	0.160***	0.227***	0.112	0.571
	(0.044)	(0.042)		
CS feedback offers sugg. for improvement (T)	0.287***	0.341***	0.350	0.252
	(0.052)	(0.052)		
CS feedback mentions something T did well (T)	0.284***	0.355***	0.225	0.255
	(0.052)	(0.052)		
T feel valued and appreciated (T)	0.020	0.046	0.503	0.430
	(0.040)	(0.040)		
HT has helped T become a better Teacher (T)	-0.011	0.037	0.247	0.286
	(0.040)	(0.041)		
CS has helped T become a better Teacher (T)	0.031	0.002	0.438	0.221
	(0.035)	(0.036)		
HT is a good manager (T)	0.026	0.092*	0.210	0.307
	(0.054)	(0.053)		
Number of CS meetings with each HT in their circuit (CS)	0.057	-0.717	0.098	5.600
	(0.509)	(0.460)		
Number of CS meetings with all staff their circuit (CS)	0.047	0.332	0.472	3.125
	(0.336)	(0.388)		
Number of CS visits to schools their circuit (CS)	0.008	1.407***	0.000	4.679
	(0.293)	(0.352)		
Number of CS meetings with all HTs their circuit (CS)	0.033	0.119	0.613	1.400
	(0.158)	(0.176)		
Suggestions to teachers frequency (CS)	0.016	-0.027	0.731	3.333
	(0.113)	(0.124)		

Table A3: Individual Components of All Other Management Index

	DI +Basic (1)	**DI +Basic +Enhd** (2)	**p-value** (3)	**Mean for Control** ' (4)
An important part of HT job is to ensure teaching skills are improving (HT)	0.113	0.131*	0.811	4.557
	(0.081)	(0.079)		
An important part of HT job is to ensure teachers are held accountable (HT)	0.257***	0.214**	0.624	4.343
	(0.091)	(0.095)		
HT encourages teachers to try new practices (HT)	0.151*	0.118	0.694	4.314
	(0.079)	(0.083)		
HT scheduled meetings with parents (HT)	-0.053	0.073*	0.003	0.836
	(0.041)	(0.037)		
Teachers receive rewards for good performance (HT)	-0.090	0.040	0.099	0.700
	(0.079)	(0.080)		
School had student atendance records (HT)	0.033	-0.012	0.361	0.900
	(0.048)	(0.051)		
School had teacher atendance records (HT)	0.042	0.042	0.998	0.943
	(0.031)	(0.032)		
Schools uses teacher feedback to guide goals (HT)	0.086	0.154*	0.460	4.243
	(0.083)	(0.083)		
Teachers share new pratices with other teachers (HT)	0.360***	0.148	0.026	4.029
	(0.087)	(0.097)		
Teachers encourage students to approach them for supplemental help (HT)	0.211**	0.092	0.220	4.029
	(0.102)	(0.111)		
The school uses student scores to establish teachers' effectiveness (HT)	0.085	0.148	0.565	4.100
	(0.107)	(0.090)		
HT presence at spot checks (Spotcheck)	0.107	0.154**	0.486	0.421
	(0.067)	(0.068)		
An important part of CS job is to ensure teaching skills are improving (CS)	-0.001	0.026	0.695	4.742
	(0.073)	(0.071)		
An important part of CS job is to ensure teachers are held accountable (CS)	-0.002	0.023	0.734	4.667
	(0.072)	(0.075)		
Schools have goals/school development plan (CS)	0.002	0.215**	0.027	4.258
	(0.098)	(0.095)		
CS tried out new ideas in school (CS)	0.018	0.124	0.294	4.197
	(0.090)	(0.101)		
Schools use student scores to guide school goals (CS)	-0.015	0.234**	0.016	4.152
	(0.105)	(0.104)		

Table A4: Management Outcomes Indices By Respondent Type

Index:	**Instructional Management**		**People Management**	
Reported by:	**Subordinate**	**Self**	**Subordinate**	**Self**
	(1)	(2)	(3)	(4)
DI + Basic Mgmt	0.598***	0.225	0.331**	0.018
	(0.133)	(0.148)	(0.161)	(0.137)
DI + Basic + Enhanced Mgmt	0.578***	0.340**	0.678***	0.339**
	(0.124)	(0.135)	(0.150)	(0.149)
Observations	210	210	210	210
R^2	0.34	0.17	0.28	0.36
Mean Dep., Control	0.00	0.00	0.00	0.00
P-Value Same Effect	0.87	0.30	0.04	0.03

Notes: The outcome variable in all regressions are standardized weighted indices of management outcomes. All regressions include baseline management index and district fixed effects. Standard errors are clustered at the school level. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table A5: Classroom Activities Conditional on Teacher Presence

	Any TLM Use	**Engaged Teacher**	**Engaged Student**	**Active Learning Index**
	(1)	(2)	(3)	(4)
DI + Basic Mgmt	0.123***	0.148***	0.105***	0.370***
	(0.026)	(0.025)	(0.025)	(0.055)
DI + Basic + Enhanced Mgmt	0.054**	0.114***	0.107***	0.251***
	(0.026)	(0.025)	(0.023)	(0.051)
Observations	1,876	1,876	1,876	1,876
R^2	0.15	0.10	0.06	0.11
Mean Dep., Control	0.71	0.64	0.70	0.00
P-Value Same Effect	0.00	0.16	0.91	0.02

Notes: All regressions include controls for whether the observation is from the first or second spot check, whether the observation is from the first or second classroom observation at each spot check, the average percent of teachers present during the baseline survey, and strata (district) fixed effects. Sample: teacher was present during the classroom observation. Standard errors in parentheses, clustered at the school level. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table A6: Classroom Activities by Period

	Teacher in Classroom (1)	**Any TLM Use** (2)	**Engaged Teacher** (3)	**Engaged Student** (4)	**Active Learning Index** (5)
Panel A: First Period					
DI + Basic Mgmt	0.144***	0.200***	0.201***	0.180***	0.473***
	(0.035)	(0.036)	(0.037)	(0.038)	(0.078)
DI + Basic + Enhanced Mgmt	0.130***	0.152***	0.193***	0.173***	0.413***
	(0.040)	(0.040)	(0.038)	(0.040)	(0.082)
Observations	1,231	1,231	1,231	1,231	1,231
R^2	0.105	0.118	0.143	0.093	0.136
Mean Dep., Control	0.66	0.48	0.49	0.50	0.04
P-Value Same Effect	0.69	0.22	0.82	0.87	0.46
Panel B: Second Period					
DI + Basic Mgmt	0.117***	0.185***	0.210***	0.180***	0.466***
	(0.038)	(0.040)	(0.038)	(0.039)	(0.080)
DI + Basic + Enhanced Mgmt	0.093**	0.100**	0.152***	0.153***	0.311***
	(0.037)	(0.040)	(0.038)	(0.038)	(0.076)
Observations	1,231	1,231	1,231	1,231	1,231
R^2	0.075	0.076	0.095	0.085	0.090
Mean Dep., Control	0.70	0.47	0.43	0.45	-0.04
P-Value Same Effect	0.48	0.02	0.14	0.44	0.05

Notes: All regressions include controls for whether the observation is from the first or second spot check, the average percent of teachers present during the baseline survey, and strata (district) fixed effects. Panel A is the first period observation and Panel B is the second period observation. Standard errors in parentheses, clustered at the school level.

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

Table A7: Norms of Acceptable Behavior

	Teacher's Opinions of Students (1)	**Teacher's Opinions of HTs** (2)	**Teacher's Opinions of CS** (3)	**HT Opinions of Students** (4)	**HT Opinions of HTs** (5)	**HT Opinions of CS** (6)
DI + Basic Mgmt	-0.141	-0.254**	-0.203*	-0.201	-0.055	0.113
	(0.119)	(0.108)	(0.111)	(0.159)	(0.166)	(0.157)
DI + Basic + Enhanced Mgmt	-0.242*	-0.301***	-0.208	-0.197	-0.185	-0.037
	(0.132)	(0.115)	(0.131)	(0.146)	(0.152)	(0.157)
Observations	461	461	461	209	209	209
R^2	0.18	0.21	0.15	0.17	0.25	0.21
Mean Dep., Control	0.00	0.00	0.00	0.00	0.00	0.00
P-Value Same Effect	0.43	0.61	0.97	0.98	0.44	0.33

Notes: See Table 6. Column 1: reports of hypothetical students by teachers. Column 2: reports of hypothetical head teachers by teachers. Column 3: reports of hypothetical circuit supervisors by teachers. Column 4: reports of hypothetical students by head teachers. Column 5: reports of hypothetical head teachers by head teachers. Column 6: reports of hypothetical circuit supervisors by by head teachers.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table A8: Work Stress and Burnout

	Teacher Stress Index (1)	**HT Stress Index** (2)
DI+Basic Mgmt	0.039	0.043
	(0.081)	(0.118)
DI+Basic+Enhanced Mgmt	0.164*	-0.000
	(0.083)	(0.116)
Observations	1,850	621
R^2	0.09	0.19
Mean Dep., Control	0.01	-0.00
P-Value Same Effect	0.17	0.70

Notes: All regressions include age, gender, experience, age squared, experience squared, and district and round fixed effects. Standard errors are clustered at the school level. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table A9: Additional Test Score Specifications

	Combined Score (1)	**Math Score** (2)	**English Score** (3)
Panel A: Limited Covariates			
DI + Basic Mgmt	0.106***	0.134***	0.067**
	(0.033)	(0.036)	(0.033)
DI + Basic + Enhanced Mgmt	0.081**	0.109***	0.050
	(0.037)	(0.039)	(0.037)
Panel B: Foundational Skills Only			
DI + Basic Mgmt	0.139***	0.183***	0.071***
	(0.027)	(0.034)	(0.022)
DI + Basic + Enhanced Mgmt	0.169***	0.203***	0.104***
	(0.029)	(0.035)	(0.027)
Panel C: Upper-Level Items Only			
DI + Basic Mgmt	0.075***	0.086***	0.045*
	(0.023)	(0.027)	(0.026)
DI + Basic + Enhanced Mgmt	0.054**	0.067**	0.033
	(0.026)	(0.030)	(0.027)
Panel D: Subset Asked of All Students			
DI + Basic Mgmt	0.118***	0.131***	0.075**
	(0.034)	(0.036)	(0.030)
DI + Basic + Enhanced Mgmt	0.114***	0.133***	0.064*
	(0.037)	(0.039)	(0.034)
Observations	5,608	5,608	5,608

Notes: Sample: all students available for the followup assessments. Outcomes: standardized latent ability of each student for combined, math, and English questions. All regressions include baseline controls for student age, age-squared, grade at baseline, baseline assessment scores, female, and strata (district) fixed effects. Standard errors in parentheses, clustered at the school level. Notes: Panel A: includes only baseline test score and strata as covariates. Panel B and C: Test questions are mutually exclusive and completely exhaustive. Panel B: Outcome is the score on the ASER-like items only. Panel C: Outcome is the score on upper level questions only. Panel D: Outcome is the score on questions asked of all students.

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

Table A10: Tested At Endline

	Student in EL (1)	**Student in EL** (2)
DI + Basic Mgmt	-0.003	-0.003
	(0.006)	(0.006)
DI + Basic + Enhanced Mgmt	-0.015**	-0.015**
	(0.007)	(0.007)
DI+Basic Mgmt X Baseline Test Score		0.006
		(0.007)
DI+Basic+Enhanced Mgmt X Baseline Test Score		-0.002
		(0.008)
Baseline Test Score	0.006	0.004
	(0.003)	(0.005)
Observations	5,893	5,893
R^2	0.018	0.019

The sample is all baseline students. All regressions include baseline controls for student grade, baseline ability on combined math and English, student age, age-squared, female, and strata (district) fixed effects. Standard errors in parentheses, clustered at the school level. * p<0.10, ** p<0.05, *** p<0.01

Table A11: Lee Bounds for Student Test Scores

	Combined Score		**Math Score**		**English Score**	
	Lower	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**
	(1)	(2)	(3)	(4)	(5)	(6)
DI + Basic Mgmt	0.105***	0.106***	0.140***	0.138***	0.062***	0.064***
	(0.021)	(0.021)	(0.026)	(0.026)	(0.022)	(0.022)
DI + Basic + Enhanced Mgmt	0.101***	0.102***	0.124***	0.128***	0.072***	0.073***
	(0.024)	(0.024)	(0.030)	(0.029)	(0.024)	(0.024)
Observations	5,546	5,546	5,546	5,546	5,546	5,546
R^2	0.737	0.735	0.625	0.616	0.700	0.702

Notes: Lee (2009) bounding method applied to sample in Table 7. See additional notes in Table 7.

Table A12: Student Test Scores: Heterogeneous Treatment Effects

	(1)	(2)	(3)	(4)	(5)
DI + Basic Mgmt	0.106***	0.098***	0.098***	0.117***	0.106***
	(0.021)	(0.027)	(0.030)	(0.029)	(0.031)
DI + Basic + Enhanced Mgmt	0.106***	0.091***	0.096***	0.121***	0.129***
	(0.024)	(0.029)	(0.028)	(0.034)	(0.035)
DI+Basic Mgmt X Baseline Test Score	0.011				
	(0.022)				
DI+Basic+Enhanced Mgmt X Baseline Test Score	0.002				
	(0.022)				
DI+Basic Mgmt X Female Student		0.023			
		(0.036)			
DI+Basic+Enhanced Mgmt X Female Student		0.034			
		(0.035)			
DI+Basic Mgmt X P4 Pupil at Baseline			0.020		
			(0.042)		
DI+Basic+Enhanced Mgmt X P4 Pupil at Baseline			0.023		
			(0.032)		
DI+Basic Mgmt X Either Parent Literate				-0.004	
				(0.034)	
DI+Basic+Enhanced Mgmt X Either Parent Literate				-0.030	
				(0.035)	
DI+Basic Mgmt X Above Median Amenities					0.002
					(0.043)
DI+Basic+Enhanced Mgmt X Above Median Amenities					-0.036
					(0.046)
Observations	5,608	5,608	5,608	5,396	5,608
R^2	0.746	0.743	0.743	0.743	0.746

Notes: See Table 7. Column 5: Amenity index calculated at the school level.

Table A13: Student Attendance

	Student Absent From School (Spot Checks) (1)	**School Reports Student Not Enrolled (Any Spot Check)** (2)	**Student Self-Reported Dropout (Endline)** (3)
DI + Basic Mgmt	0.031**	0.028***	0.001
	(0.014)	(0.009)	(0.004)
DI + Basic + Enhanced Mgmt	-0.000	0.019**	0.004
	(0.013)	(0.009)	(0.005)
Observations	11,569	5,893	5,608
R^2	0.03	0.02	0.02
Mean Dep., Control	0.17	0.06	0.01
P-Value Same Effect	0.02	0.38	0.40

Notes: All regressions include baseline test score, age, age-squared, and gender, district and round fixed effects. Standard errors clustered at the school level. Column 1: Whether the student was present the day of the unannounced spot check. The data could not be collected if classes were not in session. Column 2: Students present coded as enrolled. Teacher and head teacher reports of whether absent students were still enrolled. One observation per student. Column 3: Whether the student self-reported that they were no longer attending school at the endline survey. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table A14: Student Opinions About School

	Fave subject is Math or Eng (1)	**Like Math or English Very Much** (2)	**Want to Attend SHS** (3)
DI + Basic Mgmt	0.012	0.046***	-0.002
	(0.017)	(0.014)	(0.007)
DI + Basic + Enhanced Mgmt	-0.028	0.019	0.000
	(0.018)	(0.015)	(0.006)
Observations	5,608	5,608	5,550
R^2	0.060	0.053	0.035
Mean Dep., Control	0.788	0.793	0.966
P-Value Same Effect	0.019	0.055	0.719

The sample is all student available for the endline assessments. Column 1: The outcome variable is whether or not the child reported their favorite subject was math or English. Column 2: The outcome variable is whether or not the child reported liking math or English Column 3: Whether the child aspired to attend senior high school. Standard errors in parentheses, clustered at the school level. * p<0.10, ** p<0.05, *** p<0.01