IGC International Growth Centre

Learning in Public Schools

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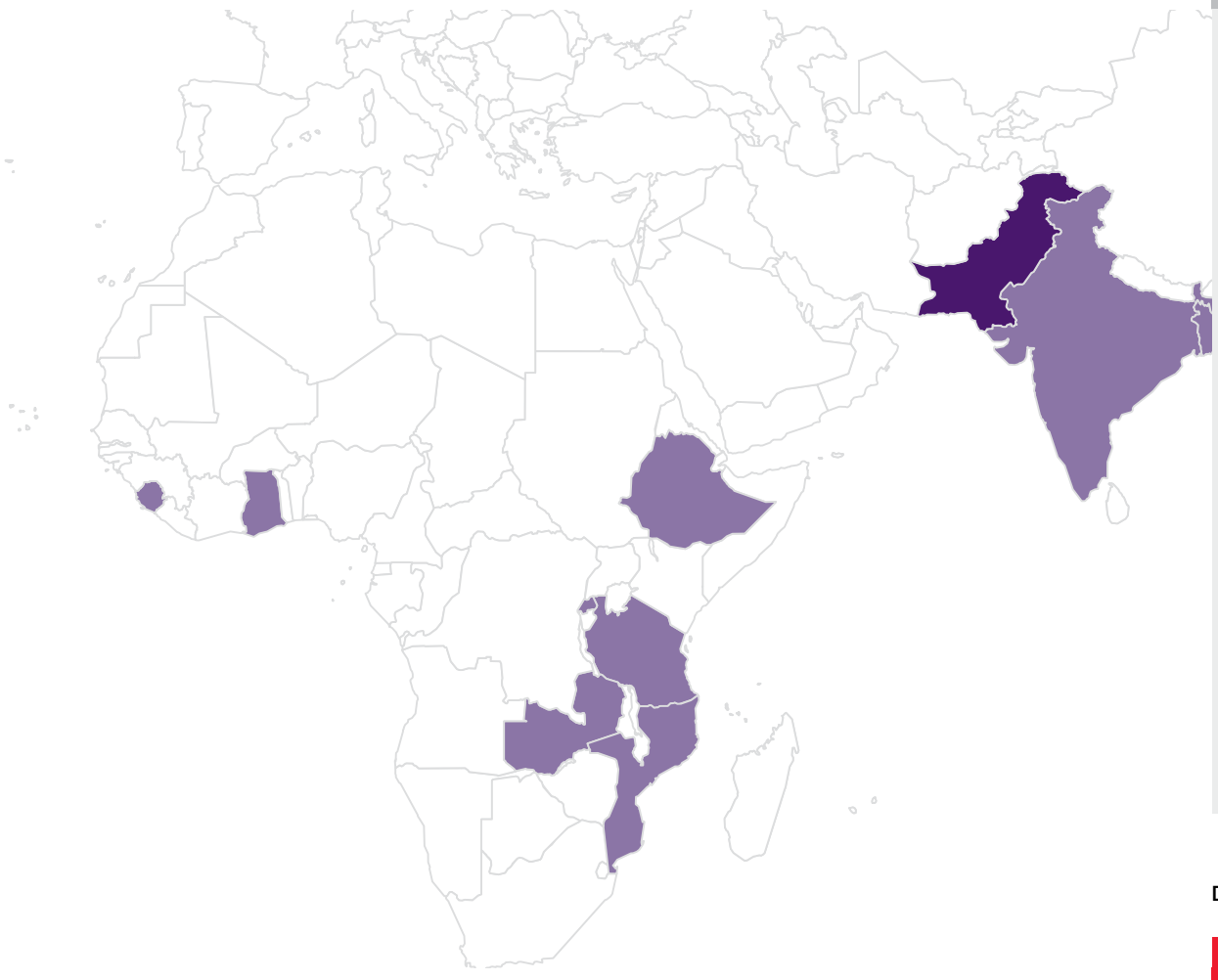

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TABLE OF CONTENTS

List of Figures

List of Tables

Acknowledgments

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Introduction

The quality of education in Pakistan has received substantial interest from policy makers and researchers alike. Studies like LEAPS (2005) and ASER (2011) show that, on average, public schools are outperformed on tests of student learning by private schools. This gap between public and private education is primarily explained by school-level factors and persists even after controlling for community and student attributes. Yet it is also well known that students in both types of schools perform poorly relative to the learning standards, where children in grade 3 are found to have barely mastered the curriculum for grade 1 (Das, Pandey and Zajonc, 2006).

On the policy front, the Government of Punjab has taken several initiatives over the last decade to improve the education system and, in turn, schooling quality. The scope of these interventions is enormous in its breadth: from public-private partnerships to community involvement in school management and from provision of missing school facilities to providing additional resources in the form of free textbooks and scholarships.[1]

Two of the more enduring institutional interventions to come out of the last decade of reforms include the establishment of Punjab Examination Commission (PEC) in 2005 to conduct annual learning assessment of elementary school children and an ambitious decentralized teacher development framework set up in 2006 through the Directorate of Staff Development (DSD). The latter intervention is known as the Continuous Professional Development (CPD) programme.

This report focuses on the quality of education in the public primary schools in Punjab and studies the recent teacher development initiative in this context. The main research questions of interest are two-fold: Within public sector, what is the variation in average test scores across schools and what school factors are correlated with that variation? What potential impact could

[1] However, unlike other developing countries such as India, few of these interventions have been rigorously evaluated in terms of their impact on educational outcomes of interest.

the new teacher professional development intervention, CPD, have on student achievement? It is the latter question that we hope to answer more rigorously in future work in this area.

For the purpose of this report, we use test score data from the PEC Class 5 exam held in 2009. Even though children enrolled in both public and private schools are required to take PEC exams, at present, the requirement is not strictly enforced on private schools. We combine PEC data with school-level information from the EMIS records to address the first question.

Analysis of exam score data suggests there is substantial variation in the quality of public schools in Punjab. This variance in school achievement is more salient when comparing schools within a district rather than comparing district-level average scores. In other words, the gap between good and bad district is relatively smaller compared to the gap between good and bad school within any given district. This basic result, suggesting the prominence of school-level factors in explaining variation in test scores, holds when we look at the smallest administrative unit available in the data, at the sub-Tehsil or 'Markaz' level.[2]

Looking at the school-level factors available in the EMIS data, the variation in school achievement on PEC exams correlates well with teaching and non-teaching inputs. Schools with higher student-teacher ratios perform poorly compared to other schools in terms of PEC scores, though the effect is small. Similarly schools with better educated and more experienced teachers and better facilities, indicated by a factor index score of basic school facilities, tend to perform better.

On the second question, we present evidence on the functioning of the CPD Programme based on information collected through a field survey in district Jhelum. The objective of this component of our research was to develop a detailed operational understanding of the CPD Programme and develop a knowledge base before attempting a more rigorous evaluation of the Programme's impact on learning outcomes. Therefore, the findings presented here are

[2] On average, a Tehsil contains 4-5 Markaz units.

tentative and mostly qualitative in nature. We do not intend to comment on the impact of the CPD program in this report.

Interviews with Teachers, Head teachers and District Teacher Educators (DTEs) reveal that the CPD programme is generally well received by schools in Jhelum. Several aspects of the program, such as mentoring visits by the DTEs and periodic assessment of pupils in grades 3-5, are deemed valuable by the teachers we interviewed. In some cases, there is an even greater demand for on-the-job mentoring and pedagogical advice than what is currently being provided. Activities organized under the CPD programme are rated favorably by all teachers but most prominently by teachers from low-performing schools. We conclude the report by highlighting some problems in the Programme along with suggestions for the future.

The next section of this report analyzes the variation in school performance as measured by the schools' average test scores in PEC exams and its correlation with school attributes. The subsequent sections place this report in context by relating it with the wider research literature on learning achievement and describe the CPD Programme in detail before presenting our findings from the pilot surveys in Jhelum.

Analysis of PEC Data

Variation in School Achievement

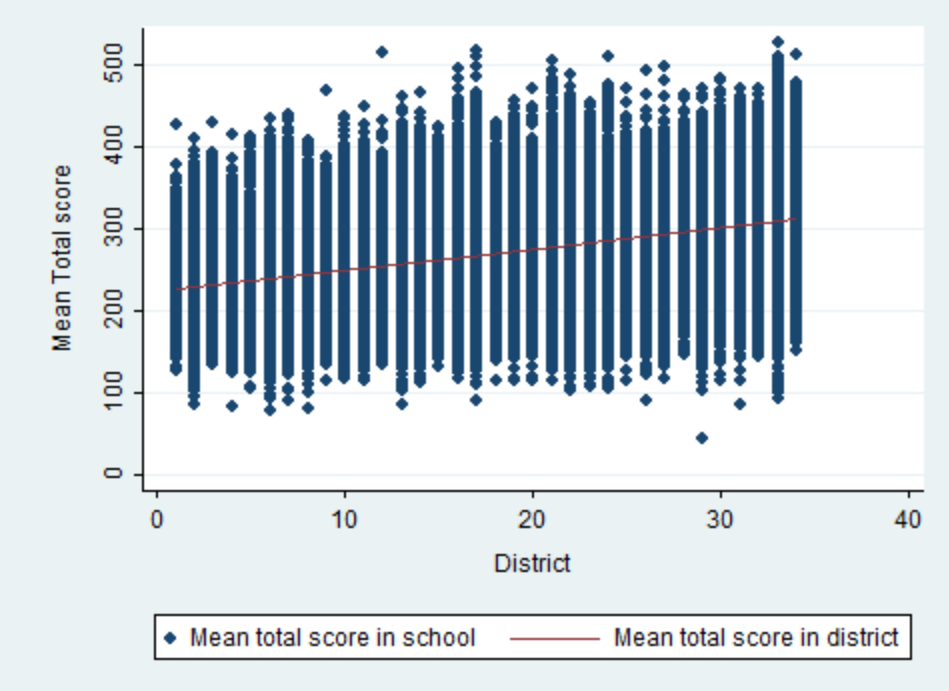
The first conclusion to be drawn from PEC data is the overall poor quality of education. In Mathematics, a subject known to be a rich reaping ground for mathematically gifted students, none of the 1.2 million students appearing in the 2009 class-V exam managed to score a perfect 100. Among public school candidates, half of the students obtained less than 39 marks and one in every five students scored less than 26. Likely none of these students in the latter category will have acquired functional numeracy even after spending six years in school. That is a huge failure.

However, there is substantial variation in test scores across schools, which indicates that not all government schools are doing poorly. To examine the variation in school performance, we use information on individual PEC exam scores to compute the average score in each school. The data contains information on 49,983 schools from all over Punjab. Administratively, the schools are classified by the district, tehsil and markaz (sub-tehsil) in which the school is located.[3]

The second important finding from the PEC data is obtained by analyzing the variance in school scores by administrative regions. In Punjab alone, there are 36 districts and more than 100 Tehsils. While some districts perform better than the others, the difference in terms of the average test scores between districts, tehsils or sub-tehsil units (called 'Markaz') is not great. Much larger differences exist across schools located within the same administrative unit (Figure 1).

Figure 1: Average Total Scores across Districts

[3] There are, on average, 1445 public schools in one district of Punjab with the minimum number of 770 schools from Gujrat district.



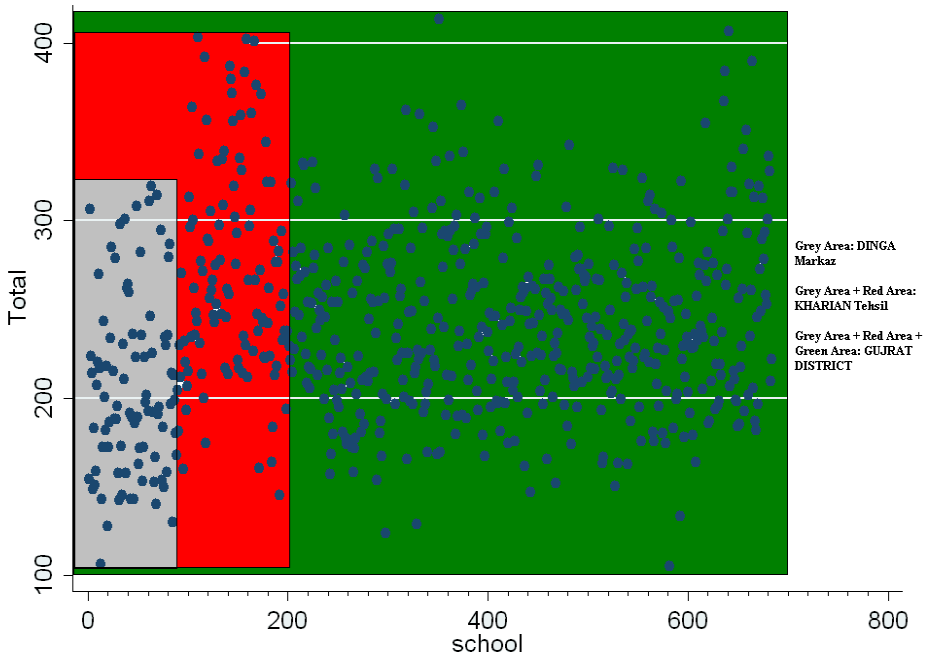
Note: The x-axis uses a unique number for each district starting with 1 for the district with lowest mean total score (all subjects included) to 36 for the district with highest total score. District names not printed to avoid clutter. A dot indicates the average score obtained by students in one government school. The line connects the district-level mean scores. The range of variation in the points vertically, for a single district, is much larger than the vertical distance between the lowest and highest points on the line.

What this "variance decomposition" reveals is that the difference between good and bad districts is much smaller in comparison to the difference in schools within a district. The above observation rules out the simplest district-level explanations of school performance. The quality of district leadership may be important but the fact that no district stands out in excellence (or lack thereof) indicates the primacy of school-level factors, and what goes on in the trenches, on the eventual learning outcomes. Most school jurisdictions have, within them, a range of schools from the very good to the dysfunctional and no district administrator seems to have found the secret to making his dysfunctional schools work again.

The same finding holds when we zoom into a district and look for spatial clustering in school achievement at the Tehsil or Markaz (sub-Tehsil) level. Markaz is the lowest administrative unit in the district education department and corresponds to the jurisdiction of an Assistant

Education Officer (AEO). Figure 2 illustrates this point by showing the variance decomposition for District Gujrat.

Figure 2: Variance Decomposition for District Gujrat



Note: The above picture "spreads out" the points in Figure 1 for one district, viz. Gujrat. A dot indicates the school-level average score, as before. The numbers on the x-axis denote unique school IDs sorted by geographical location, starting with schools falling in Dinga Markaz (grey box) within Kharian Tehsil (red box). The green box contains the grey and red boxes and covers all government schools in Gujrat district. The picture shows the range of variation in school-level average scores within different levels of department jurisdiction.

The same result holds more generally across the province and for different subjects. Variance in school achievement within a Markaz, for instance, is larger than the variance in mean Markaz-level score across Punjab as shown by Table 1. Similar variance analysis results have been obtained by Asim and Raju (2011) who demonstrate the largest component in test score variance arises from the between-school effects. That is, school-level factors explain the largest fraction of variation in test scores.

Table 1: Between and Within Variance of Test scores by Districts, Tehsils and Markaz

	District		Tehsil		Markaz	
	between	within	between	within	between	within
English	6.32	14.88	7.05	14.54	8.77	13.90
Urdu	4.84	12.14	5.56	11.92	6.76	11.51
Mathematics	4.39	12.22	5.26	11.99	6.58	11.56
Science	5.60	12.20	6.63	11.97	7.43	11.53
Total	26.49	59.86	31.33	58.39	36.63	55.86

School-level Factors

In order to conduct a more detailed school-level analysis, we combine data from PEC and EMIS using unique school identifiers in the two data sets. The EMIS dataset is available for government schools (only) and includes information on various school attributes such as the school type, gender, shift (morning or evening), availability of libraries, laboratories and playgrounds as well as provision of basic facilities (such as electricity, drinking water and toilets), school council, number of classrooms and basic construction details of the school's building etc. We also had access to district-level data from the PMIU Monitoring Reports for the study period as well as the District Census Reports 1998. About 90% of the public schools in Punjab are classified as rural schools[4] with an almost equal number of male and female schools. It is interesting to note that most of the schools were established before 1980.[5] Furthermore, based on the 2008 EMIS data, majority of the schools in the sample had a facility of clean

[4] The rural-urban classification of government schools is likely based on outdated information and is largely irrelevant given significant urban expansion in the province over the last decade or so (due to which old rural areas can now be considered as towns or cities).

[5] About half of the schools were established before 1972, while about three-fourth of the school in our sample were established before 1984.

drinking water, electricity, toilets, sewerage system and a completely built school boundary wall.[6]

Table 2: Summary Statistics: Government Schools in Punjab

Variable	Mean	Standard Dev.	Quantiles			Range
			10%	50%	90%	
Subjects						
English	42.79	16.11	22.6	41.1	65.3	[4,96]
Urdu	50.49	13.04	33.8	50.0	68.0	[8,98]
Mathematics	39.61	13.00	24.2	37.8	58.0	[4,94]
Science	43.26	13.44	26.8	41.9	62.0	[8,97]
Social Studies	39.36	12.23	24.7	37.8	56.3	[8,99]
Islamiat	56.15	11.50	41.0	56.8	70.4	[4,96]
Total	271.66	65.41	191.3	266.0	362.1	[44,528]
Inputs						
Teacher						
Experience of teachers in the education sector	17.23	6.3	7.0	18.0	24.6	[1,41]
Proportion of teachers with graduate degree	0.42	0.4	0.0	0.5	1.0	[0,1]
Proportion of teachers with intermediate degree	0.16	0.2	0.0	0.0	0.5	[0,1]
Student-Teacher ratio	55.67	38.9	18	48	100	[0,658]
Material Inputs						
Index of School Material Inputs1	-0.06	1.02	-1.57	0.22	1.16	[-2.9,1.9]
Other						
School Enrolment	15.92	16.07	3	11	33	[0,443]

On the other hand, majority of the schools did not have a library and playground. The effect of school resources on student's performance was measured using an index for school material input using factor analysis. We use the above variables capturing school facilities to form a

[6] 86.7% of the schools have access to clean drinking water, 59.2% have working electricity connections, 76.5% have useable toilets, 56.8% have sewerage and 79.0% have a completely built school boundary wall. On the other hand, 66.5% of schools do not have a library and 54.5% do not have a playground.

single factor index of school facilities.[7] Table 2 shows summary statistics for the factor index generated. The higher the factor index value, the better are the overall school material inputs.[8]

As far as the teachers' credentials are concerned, about 50% of the schools have at least half of their teachers with a college graduation, while about 25% schools have a graduate among every 2 out of their 3 teachers. Similarly, the mean experience of the teachers in education sector is 17.2 years, with 10% of the teachers having experience of over 24 years. Majority of the schools in the data sets are primary schools and have at most 6 teachers.[9] The student to teacher ratio, on average, is 56, while about 10% of the schools in our sample have a student to teacher ratio of over 100. All the key variables are summarized in Table 2 above.

Correlates of School Achievement

Using the factor index of material inputs and other key variables, we employ ordinary least squares regression to examine the correlates of school performance. Table 3 presents the results.

Table 3: Regression Results

Dependent Variable: Mean Total Score of School	Coef	Std Error
Urban	-0.38	1.06
Student-to-Teacher Ratio	-0.10***	0.01
School Level: High School	-0.10	3.83
School Level: Middle School	7.29*	3.82

[7] Since all of these were dummy variables, we use their polychoric correlations to construct the factor score.
[8] However, in cardinal terms, the magnitude does not explain much. In other words, a school with an index value twice as large compared to the other school does not imply that the former has twice as much resources.
[9] About 77% of the schools have class 5 as the highest class in the school. As will be discussed in the section on Jhelum survey, most of the government primary schools have less than 6 teachers.

School Level: Primary School	-3.25	3.86
School Level: Madrassah	4.37	5.45
Proportion of Teachers with Graduate degree	8.00***	1.30
Proportion of Teachers with Intermediate degree	4.81***	1.27
Experience of Teachers in Education Sector	0.29***	0.07
Enrolment	0.20***	0.02
Index of School Resources	0.51*	0.31
Median Age of Students taking PEC Exam	-4.57***	0.32
Gender: Male	-5.15***	0.59
District Fixed Effects	Yes	
Number of Observations	48,188	
P-value	0.00	
Adjusted R^2	0.1788	

Notes: Standard errors are robust to heteroskedasticity

Significance levels: * for 10%, ** for 5% and *** for 1%

The regression analysis shows that, all else fixed, both teaching and non-teaching inputs have a positive impact on the average school test score. The student-to-teacher ratio has a statistically significant association with the performance of the students. On average, a school with one additional student per teacher tends to score about 0.10 marks lower in the examination. However, the coefficient is small in practical terms. A 1 sd increase in student-teacher ratio, a large absolute change of 39 more students per teacher, leads to a decline in average total score of just 0.06 sd.

Similarly, the index of school material inputs is significantly and positively associated with school performance. A school with better facilities, such as a completely built boundary wall, library, playground etc., will tend to produce better results than a school with lower material inputs so schools with more resources seem to get higher scores. Again the magnitude of the estimated coefficient suggests a rather weak relation in practical terms as a 1 sd change in the factor score is associated with a less than 0.01 sd change in the average total score.

The education and experience of teachers also tends to be positively correlated with the school performance. The coefficient estimates suggest that a school with no graduate teacher will be expected to have, on average, 8 points lower than a school with all the graduate teachers, everything else constant, which equates to a 0.05 sd change in mean score for a 1 sd change in the proportion of graduate teachers.[10] Moreover, the average experience of teachers in the education sector is also positively correlated with the school's performance. A school with an additional 6 years (1 sd) of average teacher experience will tend to have 0.03 sd higher average score in the examination.

Variables measuring student enrolment, age and gender of the students are also significantly related with school performance. Our regression analysis suggests that higher enrolment is positively associated with better exam performance (the causality running in the opposite direction here). The regression results also suggest that older students will tend to have lower test scores and that girls outperform boys, other things constant.

The above results are merely suggestive in nature based as they are on multiple regression analysis. These are not meant to identify a school reform prescription and are unable to do that as the analysis suggests correlations and patterns in the data without enabling us to identify the underlying causal pathways.

Research on Learning Achievement

Trying to determine which school factor matters most in the production of education in schools has a long history in the research literature. Beginning with the Coleman Report, there has been a long-standing interest in identifying those school inputs that can improve the school's learning outputs. Hanushek (1997) provides a review.

[10] This relation does not suggest causality; it merely suggests the association of having more educated teachers to the schools' performance, as reflected by the average total score on the PEC exam. A similar, though relatively modest, association holds for the proportion of intermediate teachers in the school.

In addition to the earlier non-experimental literature, there is a large new literature which seeks to identify factors that cause increased learning achievement in schools. The interventions evaluated in this (largely experimental) literature include: additional teaching resources either provided directly for remedial instruction or indirectly through an emphasis on smaller class size, non-teaching resources such as textbooks and flipcharts, community involvement in schools, ability grouping/tracking within students and various kinds of teacher incentives through performance pay or increased monitoring (Glewwe et. al., 2008; Kremer and Holla, 2009).

On the question of teacher attributes per se, there is a lot of anecdotal evidence to suggest the importance of the role of teachers in the learning process. However, there are mixed results in the published literature on common teacher attributes such as education, qualification, experience etc. In addition, obtaining convincing estimates of teacher effectiveness is challenging due to potential non-random assignment of students to teachers which may distort such measures. Some teachers might end up with better quality students who would perform well in many different settings.

Rivkin, Hanushek and Kain use a rich longitudinal data set on student achievement in the State of Texas to control for student, school-by-grade, and in some cases school-by-year fixed effects and then relate remaining differences in achievement gains between grades and cohorts to differences in teacher characteristics. They find that a one standard deviation increase in average teacher quality for a grade raises average student achievement in the grade by at least 0.11 standard deviations of the test score distribution in mathematics and 0.095 sd in reading.

Several papers attempt to unpack teacher effect into its constituent parts. One recent strand of the literature does that by asking which specific aspects of teaching practice matter most in improving learning outcomes (Lavy, 2011; Schwerdt and Wuppermann, 2011). Lavy (2011), for instance, shows that teaching practices which instill knowledge and comprehension, often

considered “traditional teaching”, have a large positive impact on test scores especially for girls and low-income students. But so do teaching practices that aim to instill critical and analytical thinking in students (considered “modern teaching”) although the effect again varies across student sub-groups. At the same time, the author found a range of other teaching practices to be less effective in improving learning outcomes.

Within the field of education, as opposed to economics of education, there is a lot of interest in measuring and replicating good teaching practice. Good teaching can be learned much like a craft. Moreover, in this view, content knowledge alone is not sufficient for effective teaching. According to Shulman (1986), teaching requires “Pedagogical Content Knowledge”, a type of subject-matter specific professional knowledge that helps a teacher bridge the gap between “knowing” and “teaching”. For details of the theory, and its elaboration for mathematics teaching, see Ball et. al. (2008).

Beyond the general theory of teaching, professional debates on the specifics of what constitutes effective pedagogical practice have been intense and there are proponents for different approaches (Kirschner et al, 2006; Hmelo-Silver et al, 2007). As pointed out in Lavy (2011), “Zemelman, Daniels, and Hyde (1993 and 2005) provide a normative typology of teaching practices for schools in the U.S. Traditional practices that should be decreased, they say, include rote practice, rote memorization of rules and formulas, single answers and single methods of finding answers, the use of drill worksheets, repetitive written practice, teaching by telling, teaching computation out of context, stressing memorization, testing for grades only, and being the dispenser of knowledge. Modern teaching practices that should be put to greater use are manipulative materials, cooperative group work, discussion of mathematics, questioning and making conjectures, justification of thinking, writing about mathematics, a problem-solving approach to instruction, content integration, use of calculators and computers, facilitating learning, and assessing learning as an integral part of instruction.”

If pedagogy matters and better pedagogical skills can be acquired, then it might be more cost effective to teach effective pedagogical skills to school teachers than some of the alternative interventions geared towards improving learning outcomes. In the recent literature, there have been some evaluations of teacher training (Angrist and Lavy, 1998; Jacob and Lefgren, 2004).[11] Angrist and Lavy, using a sample of Jerusalem elementary schools that received funding earmarked for teachers' in-service training, show that after controlling for initial scores, pupils enrolled in schools where teachers receive in-service training perform better than those enrolled in schools where they do not. Similarly, Naseer et al (2010) have found a positive effect of pedagogical training on student learning outcomes in the case of Pakistan.

On the other hand, Jacob and Lefgren reach different conclusions. Using data from Chicago public schools[12], the authors use an instrumental variables approach to model the effect of training while controlling for race, gender, socioeconomic background etc and find no significant impact of teacher training on student achievement. Hence, it may be concluded from the above that the quality and context of a training program matters for its outcome.

With this background, we next describe the Continuous Professional Development Programme for elementary school teachers in Punjab followed by our findings from the field surveys.

Continuous Professional Development (CPD) Framework

Since its re-organization in 2004 as the pivotal agency responsible for teacher development in Punjab, the Directorate for Staff Development (DSD) has attempted to "establish a system of professional development for teachers and education personnel for enhancing the quality of

[11] In addition, there has been a multi-year randomized evaluation of a US-based teacher induction training program for new teachers. The RCT evaluation did not show substantial gains for teacher retention or attitudes from (expensive) induction training programmes although there was some modest impact on learning achievement (Mathematica, 2010). But it is important to note that the control schools in this study also had some mentoring available for the new teachers (usually by pairing them with more senior teachers) so cannot be generalized to cases where the alternative is no training.

[12] They use data from Chicago where, in 1996, public schools in which less than 15 percent of students performed at or above the national mean in standardized reading tests were put on probation.

learning in the government schools of Punjab." In addition to its in-service teacher training programs, DSD exercises administrative control over the 33 pre-service teacher training institutes in Punjab known as the Government Colleges of Elementary Training (GCETs).

The Continuous Professional Development (CPD) framework aims at providing decentralized training to primary school teachers in Punjab. This model conceives of a district as the primary unit for assessing and undertaking training activities with de-centralized delivery of teacher training at an appropriate sub-district level. In the CPD framework, all government primary schools have been grouped into clusters and, within each cluster, a school has been designated as the Cluster Training and Support Center (CTSC) to act as a local hub of CPD activities. It is the role of the CTSC to coordinate activities in its cluster and act as a link between the schools and the DSD for implementation of its policy.

The District setup of DSD consists of the District Training and Support Centers (DTSC) at the top coordinating with the Cluster Training and Support Centers (CTSCs). The DTSC is often housed at a Government College for Elementary Teachers (GCET) and the CTSC is typically located at a Government Middle/High School. The DTSC and CTSCs in each district have permanent staff for the purpose of CPD implementation and oversight called Teacher Educators (TE) and District Teacher Educators, respectively. The DTEs, on which the program rests in the district, are tasked with the responsibility to reach out to schools for learning assessment and teacher training/mentorship. The clustering of schools brings teacher support and mentoring close to classrooms and to the schools' doorsteps, and is efficient in that teachers do not have to travel long distances to acquire training.[13]

The CPD Programme focuses on the in-service training needs of the teachers and runs in parallel to the setup of Education Department in the district. The organizational chart of the

[13] Several projects and programmes including the Whole School Improvement programme (WSIP) of Aga Khan Education Services, the Education Sector Reform Assistance Program (USAID, 2003-2007) and GTZ initiative in KPK have used the idea of clustering schools and making clusters the site of professional development programs. The unique feature of DSD and its CPD framework is that a large portion of its cost is picked up by Punjab Government unlike some of the above donor-funded programs which were unable to continue once the donor funding ended.

CPD programme (Figure 3) illustrates the departments and staff involved in the CPD Framework.

CPD has the following core components:

A. Assessments

The DTEs undertake monthly assessment of each school in their respective cluster, focusing on students in class 3-5. These assessments serve three basic functions i.e. identification of weak content areas of each teacher, familiarization of students and teachers with the board examination format and ensuring adherence to the academic calendar.

In theory, the monthly assessments are standardized and monthly tests are designed and circulated by DSD according to the student learning outcomes as specified in the academic calendar. The assessments are designed on SOLO taxonomy model which provides information on the structural understanding of subject areas by the students. The data for these assessments is forwarded to the DSD on a regular/monthly basis which reviews it for formulating the ranking of schools and designing further trainings.

B. Mentoring

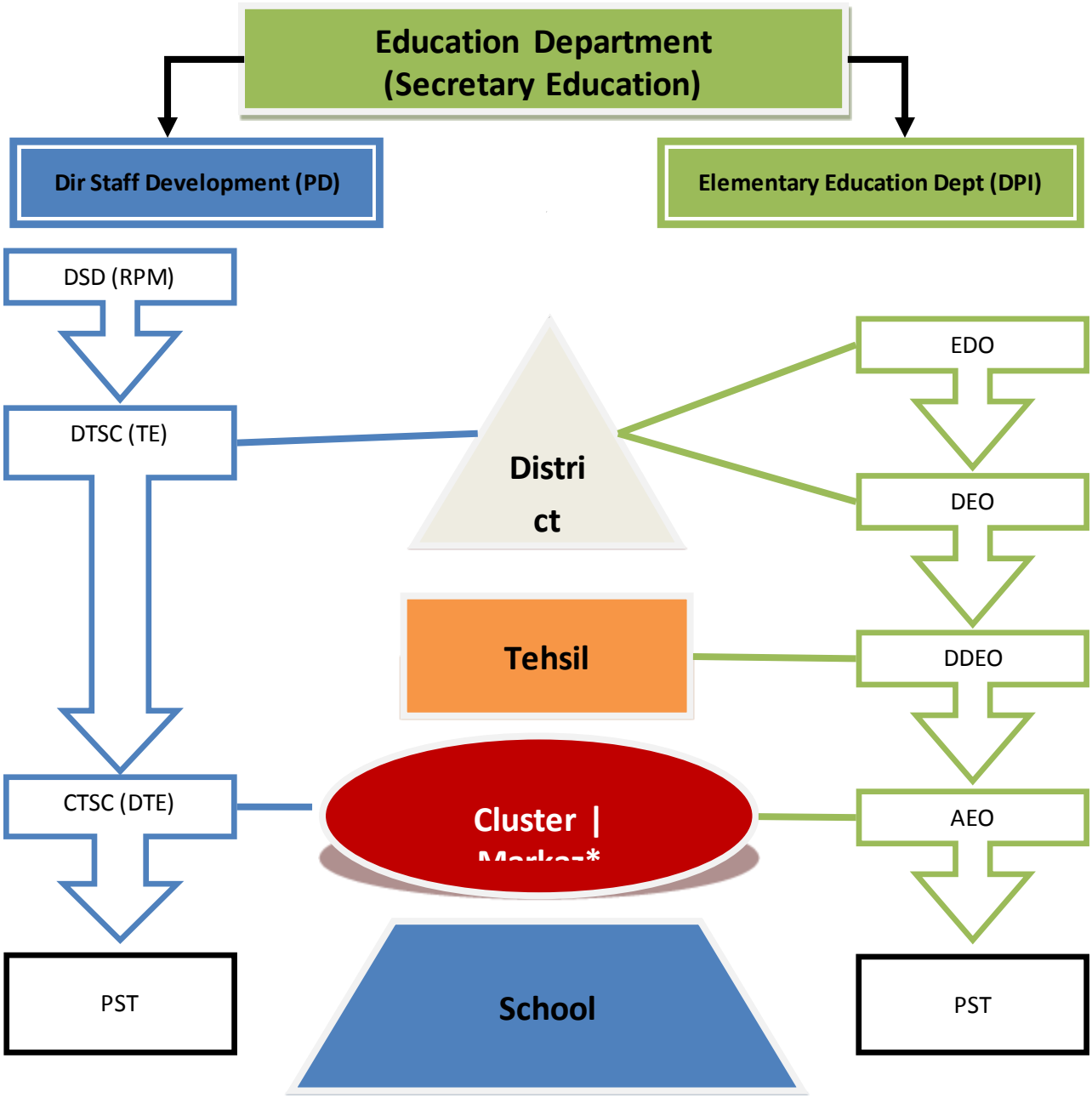
The focus areas of teacher mentoring include support on content and pedagogic activities. The first step of a mentoring visit involves the DTE observing the teacher while he/she is delivering the lesson. The DTE identifies the weak areas of the lesson and its presentation technique and gives input to the teacher on content specific areas and teaching methods, including learning aids and formulating a lesson plan.

C. Professional Development Day

The Professional Development Day (PD Day) for school teachers is held every three months at the Cluster Training and Support Center (CTSC) wherein all school teachers from one cluster are present. The PD day aims at utilizing the input from assessments and mentoring visits to design model lessons for teachers which are delivered by the DTEs. These model lessons incorporate the basic objectives of the CPD program including activity-based learning and planning a lesson as per the academic calendar (Taleemi calendar).

Next we present the findings from the field observation of CPD in district Jhelum where we visited randomly selected schools to observe classroom instruction and conduct teacher and head teacher interviews. We also interviewed DTEs and district education officials as part of this exercise.

Figure 3: CPD Framework



* Please note that, even though they are both at a sub-Tehsil level, Cluster is a smaller unit of administration (than Markaz) formed by DSD for teacher training and support. A Cluster includes 15-25 schools, on average, whereas a Markaz typically has up to 100 schools.

Key:

AEO: Assistant Education Officer
CTSC: Cluster Training and Support Center
DDEO: Deputy District Education Officer
DEO: District Education Office
DPI: Director Public Instruction
DTE: District Teacher Educator
DTSC: District Training and Support Center
EDO: Executive District Officer (Education)
PD: Programme Director, DSD
PST: Primary School Teacher
RPM: Regional Programme Manager, DSD
TE: Teacher Educator

Professional Needs and Perceptions of Public School Teachers

The universe of schools for the purpose of this study was the set of all government primary schools in district Jhelum that had at least 5 students participating in the Grade 5 PEC exams over the period 2008-2010.[14] A random sample of schools was drawn from this population using a two-stage randomized design where clusters were randomly drawn in the first stage and then, from within the selected clusters, 48 schools were randomly selected in the second stage. The sample schools belonged to 17 different training clusters representing all three Tehsils in district Jhelum.

In addition to school visits, our team observed a Professional Development Workshop for the DTEs being held in DTSC Jhelum and interviewed twelve DTEs about the Programme. The field activity culminated with a 1-day workshop involving teachers and DTEs to share the findings from the survey and seek suggestions for further improvement.

Description of Sample Schools

The primary schools in our sample were relatively heterogeneous in terms of size, resources and performance. Forty percent of the sample schools had a minimum of 5-8 students appearing in the annual PEC exams, another thirty percent had 9-14 students and the remaining thirty percent had a minimum of 15-32 students appearing per year in the exam over the 3 year period. Other measures of school size such as the overall student enrolment and the strength of teaching staff also showed similar variation.

[14] There were 233 government primary schools in Jhelum, out of 693 in total, which had fewer than 5 students taking the class 5 PEC exam. The authors felt that these schools posed a special challenge for measuring and improving quality. Indeed, some of these schools may have been too under-resourced and/or dysfunctional to be adequately helped by teacher training alone. As it turned out, a large fraction of the sample schools, drawn from the remaining 460 schools, were still operating under severe resource constraints (see below).

The following table shows the distribution of sample schools by Tehsil and their achievement in PEC Mathematics exam. For the purpose of achievement ranking, all schools in Jhelum district were split into three tiers based on the average score obtained by their students in the math exam over 2008-2010. The "top tier" consisted of the best 30% of district schools, the "middle tier" contained the next 40% and the "bottom tier" had the worst schools. Even though our sampling design was not stratified by Tehsil or math achievement, we get a decent distribution of schools across different bins (except Jhelum tehsil).[15]

Table 4: Tehsil-wise distribution of sample schools by achievement

	Jhelum	Pind Dadan Khan	Sohawa	Total
Top tier	1	5	6	12
Mid tier	8	6	5	19
Bottom tier	10	4	3	17
Total	19	15	14	48

The sample included 6 urban schools. Roughly half of the sample teachers had more than 15 years of teaching experience while a sizable fraction (17%) of teachers were fresh and had fewer than six years of experience working in the education department. In terms of qualification, the experienced lot of teachers was mostly less educated (Matric; 36%) carrying older PTC, CT or JV certifications. Most of the younger teachers, to the contrary, had at least a Bachelors degree along with B.Ed. or BS.Ed qualification.

One of the most striking findings from this work is a realization of the extent of under-provision of teachers in government primary schools. Twelve out of the 48 sample schools effectively had just a single teacher responsible for running and teaching all children in the school. That is 25%

[15] However, given logistical constraints, we did not have enough sampling power (sample size) to make inferences separately for each bin. Therefore, we restrict our analysis here to a discussion of overall means and trends in our data.

of the entire sample![16] The situation looks worse when we consider that approximately half of the sample schools in *each of the three Tehsils* had merely 1 or 2 teachers in them.

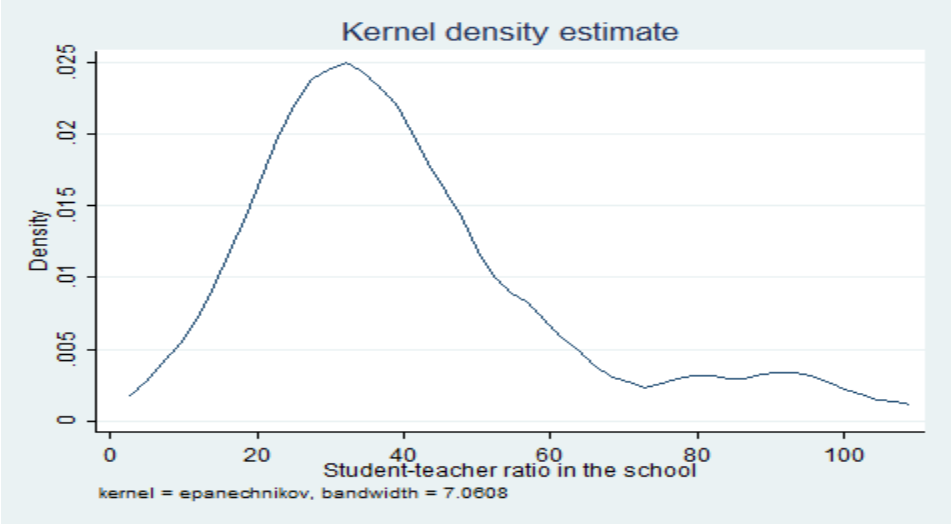
The problem is not merely due to unfilled teaching positions. According to the 2009 EMIS data, only 38% of our sample schools had more than 3 sanctioned teaching positions per school to teach the six grades (*katchi* (pre-school) along with grades 1-5). This means that, *by design*, 62% of sample schools had one teacher position sanctioned for every 2 grades. Therefore, during classrooms observation, the selected class was often found to have students from multiple grades sitting together in the same room (42% of sample schools).

Thus the resource that seems most under-supplied in government schools today is the one most central to the learning process: the teacher. To be sure, in some cases, low teacher recruitment was a consequence of the low student enrolment. Based on interviews with education department officials, the ostensible government policy is to provide a teacher for every 40 students. However, the chart below shows great variation in student-teacher ratio across sample schools; 19% of sample schools had a student-teacher ratio less than 25 while 34% had a student-teacher ratio exceeding 40.[17]

[16] In two of these single teacher schools, the teacher present in the school was temporarily visiting from another government school as a replacement for a sick/on-leave teacher. In another two schools, the local community had privately hired the teacher to keep things going.

[17] The EMIS data on Punjab paints a similar picture overall for the province. See Table 2 for province wide figures on student-teacher ratio.

Figure 4: Kernel density estimate of student-teacher ratio



Apart from the fact that the ratio of 40 students to a teacher is in conflict with the objective of providing one teacher per class/grade in schools with low enrolment, it is clearly at odds with effective discharge of a teacher's duties. Teaching 40 students in the same grade, albeit with different learning styles and learning problems, is difficult enough. Teaching 40 students from different grades with different levels of maturity and knowledge, all in the same classroom, is a different proposition altogether.

Setting the Context

As mentioned earlier, we observed one class per school. In more than 90% of cases, the class observed was Grade 4 Maths or Science. In 73% of observed classes, there were enough seats/benches for every student and 81% were adequately clean. Almost all instructors used Urdu as the predominant language for instruction whereas Punjabi was used as the pre-dominant language in 6% of the cases. A higher percentage of teachers (12.5%) used Punjabi to explain concepts or ideas while the language used for standard terminology was English in 37.5% of the cases.

The lecture duration varied greatly from one school to another; the average lecture was 61% of the total lesson time and its relative duration varied from 12.5-100%. In the remaining time, the teacher routinely asked students to read the book or do problems individually while s/he checked their homework. The observation team felt that the short duration of actual lecturing/discussion was likely due to the timing of our school visits since these happened close to the end of school year when teachers were mostly going through/revising material they had already covered.

Overall, 56% of the lessons were rated as good or very good by the trained surveyors. Separately, fifty-six percent (56%) of observed teachers took steps during the lesson to encourage students to think; 39% tried to use activity-based learning with 21% managing to execute it well (according to the surveyors) and almost half the teachers gave examples related to student life during their lecture which they executed well. In the context of CPD Programme, it is worth noting that while 85% of teachers had a DSD Lesson Planning Guide in their classroom, less than 50% of the sample teachers used a written lesson plan to structure their lecture and, of the ones who did use lesson plans, only 65% were judged to have used them effectively.

Table 5: Classroom Observation Scores, by School Quality

	Top Tier	Mid Tier	Bottom Tier
Class environment is comfortable	92	74	71
Class is well-disciplined	100	89	94
Lecture is well-organized	92	74	82
Lecture is well-organized and connected with prev/future lectures	75	26	29
Teacher is friendly and approachable	100	89	88

Teacher encourages students to think	91	95	88
Relates topics/material to students' lives	70	74	64
Assesses student learning	75	89	82
Teacher has a written lesson plan	33	53	53
Teacher engages students in individual/pair/group work	50	71	86

Note: The number in each cell indicates the percentage of schools in each category who met the listed criteria

Teachers in sample schools were asked to rate their respective school's performance on the PEC exams relative to neighboring schools. Either, teachers did not know the performance of neighboring school on PEC exams or would not acknowledge performance issues. Either way, 24% of the bottom tier schools claimed that their PEC results were excellent. The "lack of knowledge" hypothesis gets support from the fact that a sizable fraction of teachers (19%) acknowledge not knowing their school's relative performance on the PEC exam.

(Views on) Teaching and Learning

The survey collected information on teachers, head teacher and their views on issues of teaching and learning as well as appropriate interventions to improve learning within schools. In addition, as noted above, we also captured classroom teaching practice in a sample of schools through lesson observation. Our research team found indications of different teaching practices being used in the schools. The survey teams found that majority of teachers observed in top tier schools started their lectures by recalling the previous lessons. Overall, only a small proportion of teachers in higher ranked schools did not make an effort to recall the lessons, in contrast with nearly two thirds of the teachers in lower tier schools. It was also noted that

teachers in top tier schools were most likely to connect the previous lectures with lesson for the day.

Anecdotal evidence suggests that the head teacher's leadership plays a very important role in the success of a school. The head teacher in turn responds to the policy directives and priorities of the education department officials. Before CPD, all state employees visiting the schools focused on communication of information/policy decisions as well as the overall discipline through monitoring of teacher attendance etc. Therefore, not surprisingly perhaps, nearly 80% of all head teachers stated that student/teacher attendance and maintenance of discipline was their top priority for the school. Only twenty percent considered matters of learning and teaching as their priority.

The head teachers surprisingly did not think that bad teaching was a major constraint in achieving learning objectives. Most of them thought that low student motivation and lack of parental involvement were the main factors constraining student learning. However, many of the same head teachers were of the view that, to improve learning in classrooms, teachers should spend more time preparing for classes and also reach out to children with different learning styles.

Teachers, for their part, were mostly working in severely under-resourced schools. Majority of them expressed the need for para teachers to support teaching activities and overcome the shortage of teachers in the system. In response to a question regarding how to improve school performance on the PEC exam, one-third of our respondents demanded more teachers in the school and another one-third wanted more effort by teachers. Nineteen percent (19%) of respondents felt that the results could be improved by providing more training to the existing teachers. Assuming that training could also improve teacher motivation (through periodic assessments) or lead teachers to exert well-directed efforts, in-service teacher training was thus considered as one of the leading sources of learning improvement by primary school

teachers in Jhelum. Interestingly, a relatively higher fraction of teachers from the bottom tier schools reported the need for teacher training.

Table 6: Support Required for Improving PEC scores, by School Quality

	Top Tier	Mid Tier	Bottom Tier	Total
More teachers	38.5	31.6	31.3	33.3
More effort	38.5	42.1	18.8	33.3
More training	15.4	10.5	25.0	16.7
Parental/student motivation	0.0	10.5	12.5	8.3
Other systemic/resource issues	7.7	5.3	12.5	8.3

Note: The number in each cell indicates the percentage of schools in each category who met the listed criteria

District Teacher Educators, had different views on the constraints to student learning. Most of them felt that it was the motivation and ability of teachers which constrains student learning in a school. It was felt that school facilities also played an important role in it. The idea was that a better-equipped school is more likely to provide learning aids which can be useful in improving teaching or otherwise make learning fun for students. The DTEs also felt that the effort of teachers, say, in time spent preparing for class, could go a long way in improving the quality of teaching in public schools and that the accumulation of knowledge by the teachers will lead to quality improvements.

An important aspect of the CPD Programme is the new resource materials, such as Teachers' Guides and lesson plans, developed by DSD to support teachers. More than 90% of teachers reported having been provided with lesson plans and Teachers' Guides, however, majority of them could not give a satisfactory answer when asked to explain the difference between the two. The teachers in sample schools also used the buzz words such as "activity based learning" to describe the new lesson plans to the research team. But even a simple technique such as

examples from everyday life is on average used only four times during a week. The average reported use of classroom discussion, group activity and practical activities is even smaller. The openness to training may vary from teacher to teacher depending on various factors but the DTEs report that motivation plays an important role in the effect of training on a teacher.

By and large, our respondents believed that teachers who were more qualified or younger were more open to ideas in general. Encouragingly the DTEs also reported that teachers were receptive to ideas from their fellow primary school teachers (PSTs). Perhaps surprisingly, when asked what kinds of teachers were most receptive to learning from fellow PSTs, 16% of the DTEs reported more experienced teachers. This is very important as the more experienced teachers in the public school system were usually the least qualified. This means that needs-based cluster training support can be critical to improving the quality of teachers in public schools.

Perceived Assessment of CPD

When asked directly about teacher training, almost all teachers (96%) regarded it as important. Eighty-four percent of the teachers were familiar with the term "CPD" although almost all correctly identified their cluster center school and had attended PD Day trainings. A large majority of teachers (62.5%) rate CPD as 4 or 5 on a scale of 1-5 (5 highest). Teachers were also generally positive about the DTE as 97.5% of them thought that DTE was highly motivated about his job, provided useful feedback (95%) and provided teaching advice through model lessons (79%). However, 74% of the teachers interviewed also said that they would prefer if the model lessons were delivered in class rather than at the CTSC.

The observations from school teacher and head teacher surveys were corroborated through interviews with the DTEs. All the DTEs viewed the CPD program as making positive contribution to the quality of teaching. In the DTEs view the biggest impact was being made in the area of teaching methodology and techniques. Nearly half of them reported that the teachers had

learnt new teaching methods. This was probably true as the DSD had been spending resources on introducing activity based learning in the schools. The DTE trainings and material provided to the schools such as the Teachers' Guides had substantial focus on activity based learning and use of everyday material for teaching in the class room.

Among PSTs, there was wide agreement that the core components of the CPD had a positive impact on teacher's performance and their motivation. For instance, PSTs regarded monthly **assessments** carried out by the DTE as an effective tool for disciplining the teachers and students. By following a monthly schedule of assessments, teachers felt that they were able to plan and implement the academic calendar more effectively. Some of the teachers described the subsequent use of assessment data in formulating school rankings as inducing competition among schools, which in their view had improved their performance. However, some teachers regarded the grading process of these assessments as an additional burden. This was due to the fact that the DTEs required the PSTs to grade the (typically, other school's) tests. Additionally a portion of school teachers, especially those serving in single teacher schools, regarded the assessment data as not providing an accurate picture of their performance as they were being grouped with other schools where the student teacher ratio was lower. When asked regarding their satisfaction level with the CPD assessment of their school, all of the teachers responded positively even though 38% held the view that assessments needed to improve.

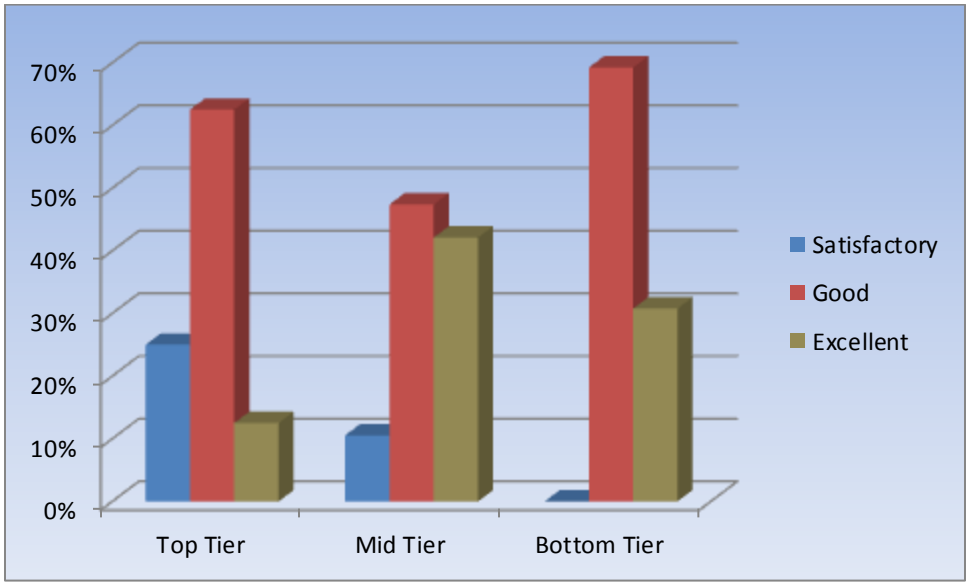
The DTEs themselves viewed assessment as a very useful activity. The results of school assessments were used in identifying the support needed by particular teachers. More than half of the DTEs reported that they used the information from assessment to either mentor teachers directly or use the results to assess their training needs. The assessment data was also being used to provide feedback to the school besides being forwarded to DSD for policy analysis. This is an important observation because it shows that the assessment is not viewed as a mechanical activity which had to be undertaken rather the DTEs make best possible use of the information collected from such assessments.

However, there is no uniform grading policy for marking these assessment tests across the province. This raises logistical challenges for the DTEs who have to disseminate, administer and collect assessment papers for all schools in their clusters. In lieu of this some of the DTEs suggested holding quarterly rather than monthly assessments. The DTEs also recognized that, within DSD, there is no incentive structure to reward well performing schools and teachers.

The **Mentoring Visits** by the DTE are an aspect of the CPD wherein teachers remain in regular contact with the department. On average, the DTEs spent 3.4 hours at each school during their mentoring visits. Therefore teachers regarded these visits as a useful source of information about new developments such as lesson planning, Teachers' Guides and developing low-cost material aids. This is especially relevant because much of the printed material of the DSD is in English language which the teachers find difficult to understand. The teachers find it helpful that the DTEs explained such material in a manner which was easy to understand. The teachers regarded the mentoring visits as positive reinforcement to such an extent that many of the teachers demanded that the frequency of such visits be increased. Generally, the teachers required a more customized approach to these visits in terms of the DTE delivering model lessons at their school rather than at the cluster centers (CTSC). Specifically, this demand was expressed by 74% of the teachers surveyed.

Overall, the teachers were able to clearly distinguish the role of the DTE from other monitoring officials such as the AEO and DDEO as well as the MEA. This is signified by the following: on a scale of 1 to 5, 78% of the teachers rated the DTE as being 4 or above as compared to only 13% for the MEA (monitoring official). Similarly 78% of the teachers regarded the DTE as being helpful in resolving their outstanding issues and 97% of the teachers stated that the DTEs provide feedback on their teaching. The DTEs were seen as mentors by the primary schools teachers which is why they had such a high approval rating. As the following figure indicates, the mentoring visits were most appreciated by schools in the bottom tier of score distribution.

Figure 5: Rating of DTE's Mentorship Visit by School Quality



The DTEs' duty to mentor and train the teachers under the CPD framework requires distribution and use of support material. The support material is meant to help the teachers in improving the quality of their teaching. We found that the material disseminated by DSD was frequently used by teachers as more than 80% of teachers reported that they used the material provided to them. The DSD's "Teacher Guide" was also frequently reported to have been used. Overall the material was found to be present in 66.7% of the classrooms observed.

As the quarterly PD Day activities take place at the cluster center school, its ease of access is an important logistical requirement. For 79% of teachers, the CTSC school was located within 30-minutes of travel time away from their own school by the most common means of transport and for 68% of teachers it was 30-minutes away from home. Besides convenient location, 79% of teachers felt that they got adequate attention and 68% of teachers were of the view that the PD Day activities were linked to prior school visits by the DTE.

Still, many teachers wanted the training cluster to be even smaller than its current size to allow greater professional exchange among teachers. Sixty-nine percent of our respondents were in favour of a smaller sub-cluster; 87.5% were happy to be mentored by a colleague and 67.5%

were willing to lead such a sub-cluster themselves (78% of teachers within the top tier were willing to lead a sub-cluster, 71% within the mid tier and 57% in the bottom tier).

Problem Areas

Despite being viewed favorably by the teachers, the end users of the program, there are a lot of problem areas in the current working of this framework. The first and most important is the relationship of the program with the setup of Education Department in the District. As discussed earlier, the program works on a model of mentorship in which DTEs help the teachers identify their weak areas and then support them in removing those weaknesses. All of this depends on interest of the teacher in improving his/her skills. The problem arises when a teacher is not interested in working with the DTE. Though there has not been a major breakdown of this kind, as is clear from the DTE rankings and attendance of teachers in cluster meetings, the system required to deal with such a situation has not been put in place according to interviews with the DTEs. In theory, the office of Executive District Officer-Education is supposed to nominate an officer to act as liaison between the department and the DTEs, thereby completing the feedback loop on the performance of teachers. In practice, this has not been the case.

The CPD framework was envisioned to be closely linked with the current set up of school education. The Head of the high school which acts as CTSC is typically appointed as the Head of CTSC, with the responsibility to check on the performance of DTEs and send annual Performance Evaluation Reports to DSD. However it was reported that since they were not required to visit schools in the cluster they were not properly aware of the functioning of the CPD system. Thus the CTSC head cannot directly provide guidance to the DTEs though he/she has control over the resources that are crucial for working of the program. The DTEs reported that these resources were seldom made available to them. The role of CTSC is also very important if the system of schools in the cluster has to work closely. Currently many primary schools do not have properly constructed classrooms let alone labs and other resources for activity based learning. But almost all high schools have science labs which can come very

handy in explaining simple ideas of science to primary school children. But for that to happen the CTSC head has to take ownership of the cluster and the CPD program.

The focus on teaching methodology also points towards a weakness of the program. As the entire focus is on activity based learning and how to deliver effective lessons, the subject/content knowledge of the teachers has not improved greatly. The DTEs themselves reported in focus group discussions that basic concepts in subjects such as math and science were among the weakest areas that needed immediate attention. There is also a need for English language courses for DTEs if they are to improve the English language knowledge of the primary school teachers including ones with almost no knowledge of the language.

Finally, multi-grade teaching is a reality in public schools in the province. By different accounts there is a shortage of tens of thousands of teachers in the public education system. While the appropriate response to this problem requires additional resource spending on education and may have to wait for the commensurate political will, existing teachers can be trained in more effective teaching methods to specifically deal with multi-grade instruction. The CPD programme attempts to address the problem of multi-grade teaching but has so far included only one module on it which does not sufficiently equip the DTEs to provide meaningful strategies/coping ideas.

References

Angrist, Joshua D. and Lavy, Victor. "Does Teacher Training Affect Pupil Learning? Evidence from Matched Comparisons in Jerusalem Public Schools." National Bureau of Economic Research. (1998). 30 May 2011 < http://www.nber.org/papers/w6781>

"Annual Status of Education Report (Rural) 2010" South Asian Forum for Education Development (2011). 20 May 2011 < http://www.safedafed.org/aser/home.html>

Ball, D. L., M. H. Thames and G. Phelps. "Content Knowledge for Teaching: What Makes It Special?" Journal of Teacher Education 59.5 (2008): 389-407.

Das, J., P. Pandey, & T. Zajonc. "Learning Levels and Gaps in Pakistan." World Bank Policy Research Working Paper 4067. (2006).

Glewwe, P., A. Holla, and M. Kremer. "Teacher Incentives in the Developing World." In Matthew (ed., forthcoming). *Performance Incentives: Their Growing Impact on American K-12 Education.*Springer. Washington, DC: Brookings Institution Press (2008).

Hanushek, Eric A. "Assessing the Effects of School Resources on Student Performance: An Update." Educational Evaluation and Policy Analysis 19.2 (1997): 141 – 164

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. "Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006)." Educational Psychologist 42 (2007): 99–107

Jacob, Brian A. and Lefgren, Lars. "The Impact of Teacher Training on Student Achievement: Quasi-Experimental Evidence from School Reform Efforts in Chicago." The Journal of Human Resources, 39.1 (2004): 50 – 79

Kirschner, Paul A., John Sweller, and Richard E. Clark, "Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching," Educational Psychologist, 41(2) (2006): 75-86.

Kremer, M., and A. Holla. "Improving Education in the Developing World: What Have We Learned From Randomized Evaluations?" Annual Review of Economics. 1.1 (2009): 513-545.

Lavy, V. "What Makes an Effective Teacher? Quasi-Experimental Evidence," NBER Working Paper 16885. (2011).

Mathematica Policy Research. Impacts of Comprehensive Teacher Induction: Final Results from a Randomized Controlled Study. (2010). April 4, 2012 < http://www.mathematica-mpr.com/newsroom/ releases/2010/Teacher Induction 6 10.asp >

Ministry of Education, Government of Pakistan, (2009). *National education policy, 2009*

Naseer, M. F., M. Patnam and R. Raza. "Transforming public schools: impact of the CRI program on child learning in Pakistan." Economics of Education Review 29 (2010): 669-683.

"National Assessment Findings (2006)." National Education Assessment System, Government of Pakistan (2006). 20 May 2011 < http://www.neas.gov.pk/Document%20Center.html>

Rivkin, Steven G., Hanushek, Eric A. and Kain, John F. "Teachers, Schools, and Academic Achievement." Econometrica 73.2 (2005): 417 – 458

Shulman, L. S.. "Those who understand: Knowledge growth in teaching." *Educational Researcher*, 15(2) (1986): 4-14.

Schwerdt, G. and A. C. Wuppermann. "Is Traditional Teaching Really All That Bad? A Within-Student Between-Subject Approach," Economics of Education Review, 30 (2011): 365-379.

Tahir, Andrabi et al. “Learning and Educational Achievements in Punjab Schools (LEAPS): Insights to inform the education policy debate.” The Leaps Project . (2007). 20 May 2011 <http://www.leapsproject.org/site/>

Zemelman S., H. Daniels, and A. Hyde. Best Practice, Today's Standards for Teaching and Learning in America's Schools. Heinemann, Reed Elsevier Incorporation.(1993 and 2005)

List of Officials Interviewed

Mr. Nadeem Irshad Kayani, Programme Director, DSD

Mr. Javed Malik, Executive District Officer (Education), Jhelum

Mr. Jamil Najam, Former Director Public Instruction (Elementary), Punjab

Mr. Shahid Saleem, Deputy Director Planning, DSD

Mr. Azmat Siddique, Regional Programme Manager, DSD

Mr. Mukhtar Hussain Shah (DTE/TE) and staff at DTSC Jhelum