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## Improving Primary Education in Pakistan: An Examination of the Association between School Autonomy and Children's Learning Outcomes

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# Improving Primary Education in Pakistan: An Examination of the Association between School Autonomy and Children's Learning Outcomes

## **Abstract**

The purpose of this study is to explore the impact of the delegation of financial authority to public primary schools through Parent-Teacher Councils (PTCs) on learning outcomes of primary school children in the Khyber Pakhtunkhwa (KP) province, Pakistan. The learning outcomes were measured in three subject areas (Urdu, English, and Mathematics). Three sources of data were used: a) Education Management Information System (EMIS), which is obtained from the Ministry of Education KP and is an official compilation of institutional data on education; b) Annual Status of Education Reports (ASER), which is a household based, citizen led survey for evaluating the learning effectiveness of children of age 5-16 years; and c) a specially designed survey questionnaire used to compile information about PTCs and school quality from 222 public primary schools in the KP Province. Results show that *school size, separate classrooms and children's attendance* are significant in determining Urdu reading skills; whereas *school size monograde schools* and *PTR (grades 3-5)* are significant in determining English reading skills as well as numeracy skills.

## **Keywords**

school autonomy, learning outcomes, rural primary schools, Parent-Teacher Councils

## **Cover Page Footnote**

I gratefully acknowledge the insightful comments received from the editors and four anonymous reviewers.

# **IMPROVING PRIMARY EDUCATION IN PAKISTAN: AN EXAMINATION OF THE ASSOCIATION BETWEEN SCHOOL AUTONOMY AND CHILDREN'S LEARNING OUTCOMES**

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## **Introduction**

Governments around the world are introducing a range of strategies to improve the quality and quantity of education services provided by public schools. One such strategy is decentralization of autonomy from the central government to the school level, popularly known as School-Based Management (SBM). Autonomy in education can be viewed from three perspectives: political, financial, and administrative or bureaucratic autonomy. Political autonomy refers to assigning power to political representatives at lower levels of government (Fiske, 1996). The recent local government elections held in 2013 in Pakistan is an example of devolution of political autonomy from the provincial to local governments - districts, tehsils and village councils. Fiscal autonomy, inter alia, concerns with imposition of taxes and revenue generation by the provincial and local governments and the discretion for allocation or reallocation of resources (Verhoest, Peters, Bouckaert, & Verschuere, 2004). Administrative autonomy refers to transferring the control of the district workforce - setting the rules and modalities such as salary, career path, and number of employees of the district's workforce - from the province to the local governments (Fiske, 1996).

In Pakistan, the devolution of autonomy to schools is being emphasized by National Education Policies since 1959 with a renewed interest in community participation since 1992 (Ministry of Education, 1992; Farooqi, 2011). However, it was not until the passage of Local Government Ordinance (LGO) in 2001 that some of the provincial subjects, education being one of them, were devolved to the districts. The district governments were tasked to administer primary and secondary education (Farooqi, 2011). Under the LGO 2001, the School Management Committees/Parent-Teacher Associations (SMCs/PTAs) were created and their functions envisioned to create venues through which communities can get involved in school governance and decision-making (Nayyar-Stone et al, 2006). Though SMCs/PTAs were in place in all the four provinces their role was almost negligible in school improvement due to lack of fiscal and administrative autonomy (Shah, 2003).

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The Government of Khyber Pakhtunkhwa took a lead in this regard and initiated a series of reforms in 2006-07 to grant fiscal and administrative autonomy to all the 28,000 public schools in the province. As a first step, the Government renamed the Parent-Teacher Associations (PTAs) as Parent Teacher Councils (PTCs) and increased their non-salary budget from Rs. 2,000 (US\$ 20) lump-sum per classroom to Rs. 7,000 (US\$ 70) per classroom per annum for the operation and maintenance of schools (Elementary and Secondary Education Department [E&SE], 2013). Second, a mechanism was devised for upfront transfer of budgets to the bank account of the PTCs right at the start of a financial year so that the schools can spend it on need-basis (ibid). The previous mechanism of centralized purchases was done away with which was prone to corruption, delays in purchases, and poor quality of items. Another important feature of the fiscal autonomy was local decision-making: the PTCs were authorized to spend the budget on need-basis hence giving them the authority to make the spending decisions on their own. Discussions with the head masters – members PTC and co-signatories of PTC accounts who are authorized to operate council's bank account – and analyses of various national and international assessment reports at that time revealed that due to the fear of bureaucratic audit, schools were reluctant to spend the funds and hence every year the budget would get lapsed. In order to resolve this issue, a system of independent, third-party audit, once in three years, was introduced (ibid). Also, the budget was mandated to be non-lapsable in case schools do not utilize their budgets during a financial year. Furthermore, the PTCs were authorized to hire a contract teacher on temporary basis and to pay his/her salary from the PTC budget. Other features of the reforms included restructuring of the council's composition, formulation of PTC functions and community participation especially parents. These features have been published as a guide, for general as well as stakeholders' information, known as PTC Guide in 2007 and are still being used.

As mentioned in the beginning, the objective of devolving authority to schools was to improve the productivity of schools. Hence, this study investigates whether PTC reforms have affected real change on the ground - by examining the association between PTC reforms variables and children's learning outcomes in all three categories of schools that are girls' only, boys' only and mixed public primary schools in KP.

### **Theoretical Framework**

This section develops a theoretical framework for understanding how PTC reforms are likely to create conducive school environment and what kinds of impact such an environment may have on students' learning outcomes. Conducive school environment, in case of KP province, was devolution of decision-making authority over two out of five major PTC functions - budget (allocating budget) and maintenance and infrastructure (purchase of educational materials and improving infrastructure). The other three functions of PTC, as characterized by di Gropello (2006) are: personnel management (hiring and firing teachers and other school staff), pedagogy (developing curriculum), and monitoring and evaluation (monitoring and evaluating teacher performance and student learning outcomes) (Barrera-Osorio, Fasih, and Patrinos, 2009; di Gropello, 2006). However, these areas were not devolved to the PTC in KP province and hence are not assessed in this study.

To measure the impact of such a school environment on students' learning outcomes, two major strand of literature exists: education literature and economic literature. Education literature has focused on self-diagnostic questions i.e. the project staff had a choice to correct issues that arise during the implementation (Barrera-Osorio, Fasih, and Patrinos, 2009). This kind of literature has applied micro-evaluation techniques such as randomized control trials, difference-in-difference and regression-discontinuity designs to interpret specific interventions

(Hanushek, Link and Woessmann, 2011; Pradhan, Daniel, Amanda, Maisy, Arya, Armida, and Rima, 2014). On the other hand, economic literature has addressed questions of budget and accounting system and personnel management (Barrera-Osorio, Fasih, and Patrinos, 2009). Such studies have used education production function model to understand how factors like budget, and school resources affect students' educational outcomes e.g. school attainment, enrolment, and learning (Chudgar and Shafiq, 2010; Hanushek, Link and Woessmann, 2011; Jimenez and Sawada, 2003; di Gropello and Marshall, 2005).

Motivated by the second strand of literature, this paper uses education production function model as the theoretical basis for econometric specification because it argues that school inputs (budget and school resources) affect student's outcomes and the effective way to improve this input in the production function is to give the school the autonomy over those functions. Besides, the nature of PTC reform (devolution of financial autonomy), availability of data and nature of research question (to assess the association between PTC reforms and children's learning outcomes) necessitated the use of education production function. For a detailed discussion on education production function model see Rahim (in press: "theoretical framework", para 3).

As mentioned above, PTC reforms resulted in various interventions such as: increase in non-salary budget per classroom per annum, opening of PTC bank accounts by all public schools, transfer of budget directly to the PTC bank accounts, timely availability of budget, need based spending, introduction of third-party audit thus replacing traditional bureaucratic audit, exempting PTC budget from being lapsed, hiring teachers, restructuring of PTC composition, formulation of PTC functions and ensuring community participation. These interventions resulted in improved students' attendance, school condition and improved learning outcomes.

Based on Pradhan et al's (2014) framework this study entails the intermediate steps along a path from fiscal devolution to improved learning outcomes. Mainly these steps relate to: opening of PTC bank accounts and transfer of budget directly to the PTC bank accounts by all public schools, need based spending, exempting PTC budget from being lapsed, introduction of third-party audit, ensuring community participation, hiring teachers, restructuring of PTC composition and formulation of PTC functions (see Figure 1). However, unlike their study that explored devolution from an organizational perspective in Indonesia, that is, if members were elected, and there was linkage with the village council how does that impact student outcomes, this study explores the relationship between PTC reform (devolution of financial autonomy) and students' learning outcomes through education function model. Various aspects of PTC reforms were assessed to analyze the association between PTC and learning outcomes such as: timely availability of funds, funds spent, parental involvement, students' sitting arrangement, students' attendance, school size, PTR, and multigrade schools.

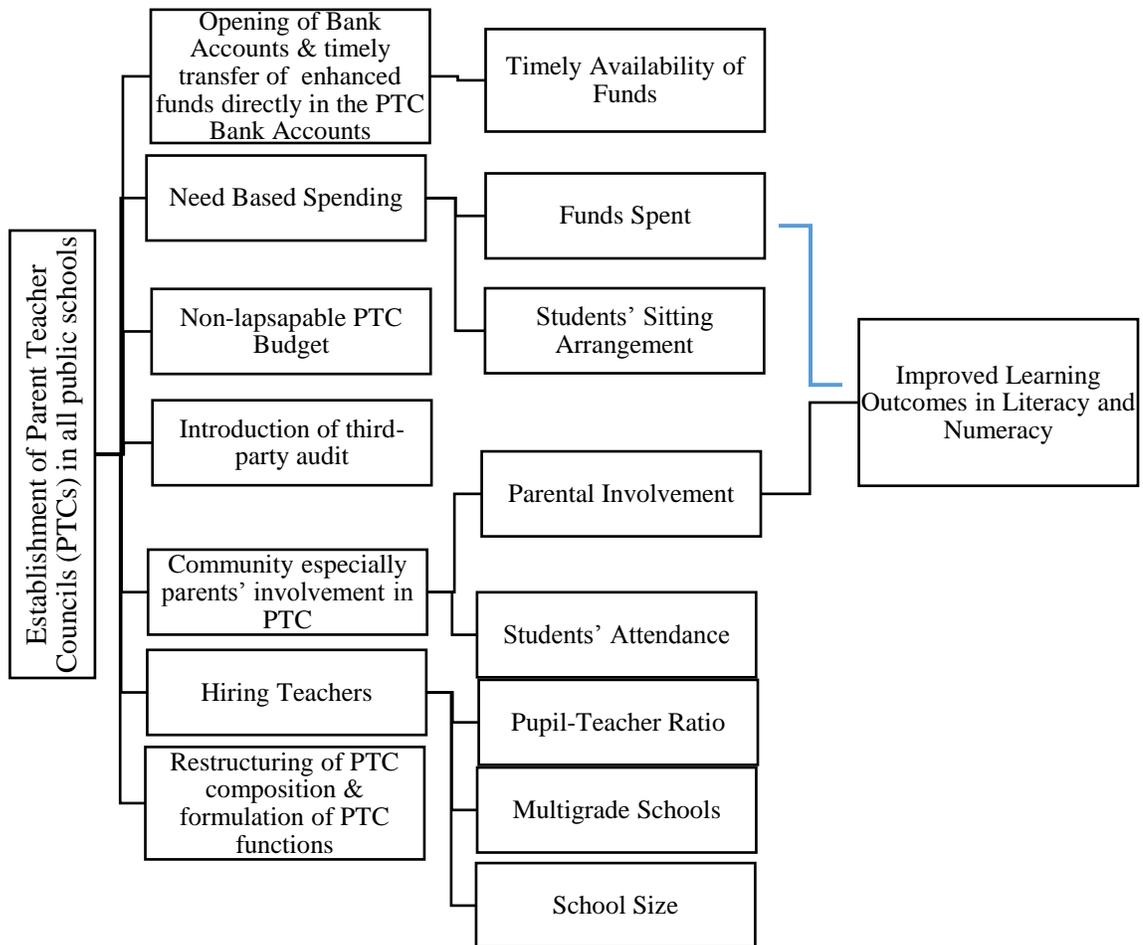
### **Literature Review**

As mentioned in the beginning, the objective of devolving authority to schools is to improve the educational outcomes of students. Little research has been conducted so far to understand the relationship between fiscal autonomy and educational outcomes. The results have been mixed with countries like Philippines, Indonesia, Kenya, El Salvador, and Nicaragua (Khattari, Ling and Jha, 2010; Suryadarma et al, 2006; Sawada and Ragatz, 2005; Jimenez and Sawada, 2003; King and Özler, 1998) showing positive results while countries like Guatemala, Brazil and Honduras show no evidence of the reforms on test scores (Vásquez, 2012).

On the positive side, Gunnarsson, Orazem, Sánchez, & Verdisco (2009) found in their analysis of eight Latin American countries that school autonomy has a positive and statistically significant impact on the test scores of third and fourth graders. The authors measured the impact of school autonomy, community participation and school resources on student outcomes. Degree

of autonomy was measured with scale variable ranging from 1 (no authority) to 3 (high authority). School autonomy variables comprised of degree of autonomy in: hiring personnel, budget allocation, designing curriculum, disciplining and evaluating students and organizing extracurricular activities. The variables related to community participation consisted of participation of parents in school activities and children development. School resource variables were mainly related to the quality and quantity of school supplies. Using OLS method, Gunnarsson et al (2009) found that school autonomy has a positive impact on test scores when the government accorded the schools the right to manage as well as when the community willingly exercised local control by participating in day-to-day affairs of school. On the other hand, school autonomy had no effect on test scores when the schools did not willingly exercise local control although the government accorded them the right to manage. Other findings of the study are: school supplies shortages negatively affect language and mathematic test scores; parental participation increases language test scores but does not affect mathematic score; schools in localities with more educated parents are more autonomous, have more parental participation, have adequate school supplies that lead to better school outcomes.

**Figure 1: The Influence of School Autonomy on Children’s Learning Outcomes. Modified version of the framework presented by Pradhan, Daniel, Amanda, Maisy, Arya, Armida, and Rima (2014).**



The findings of Gunnarsson et al's (2009) study are consistent with that of Bandur (2008) in Indonesia who found out that SBM in primary schools resulted in increase in student achievement in reading, mathematics, sports and local agriculture skills. Their research indicates that the increase in test scores happened along with other changes happening at the same time such as: direct allocation of block grants from central government to primary schools, better school facilities and teaching aids, higher parental participation, transparency in making annual school budget and involvement of external educators in setting up school policies, principal leadership roles.

Using difference in difference and propensity score matching technique, Khattri, Ling and Jha (2010) found that SBM interventions such as parents' training in SBM and direct funding for SBM had a small but positive effect on mathematics, English and science test scores of fourth, fifth and sixth graders in 23 school districts in Philippines. In a randomized trial in Western Kenya, Duflo, Dupas, and Michael Kremer (2009) found that students in schools where school committee were given extra training resulted in significant improvement in test scores. Similarly, Suryadarma et al (2006) found that students in schools that hold regular staff meetings received higher scores on both the mathematics and dictation tests in Indonesia. The authors contend that schools managed in a more participatory way tend to perform better.

In contrast, Vásquez (2012) in his research on rural and urban Guatemala examined the impact of community managed schools (CMS) as well as two other interventions namely, bilingual schools and multi-grade schools on learning outcomes of first and third graders. Using seemingly unrelated regression (SUR) method on 2004 official data, which had information about school resources, teacher training and learning environment, the author found comparable learning level of third graders between CMS schools and traditional public schools in rural areas. However, the learning level of students in CMS schools was less than that of traditional public schools both in urban and rural areas. They also found no impact of teacher characteristics (experience, gender and training) and school material on the test scores of third and fourth graders.

Several factors could contribute to reconciling these mixed conclusions, such as: difference in the research method employed by the study (such as OLS regression, difference-in-difference, SUR); differences in the type of SBM adopted by the country; differences in level of aggregation (student, school or country level); comparisons between SBM schools versus comparison of SBM schools with traditional public schools and finally the time period between implementation of SBM adoption and data collection. According to Bruns, Filmer and Patrinos (2011), reforms like SBM take five to eight years to produce the desired results. They argue that SBM intervention can have a positive effect on increasing attendance, reducing repetition and failure rates, however, outcomes such as dropout and test scores take longer to change because the initial years of reforms are adjustment years during which changes in personnel or management occur and hence the reforms may not produce the desired results.

Another factor for these inconclusive findings is that these studies have used various indirect linkages to examine the effect of SBM on learning outcomes. For example, Bandur (2008) analyzed three correlations in Indonesia: first, the correlation between decision making authority and teaching/learning environment; second, the correlation between decision making quality and student achievement; third, the correlation between teaching/learning environment and student achievement. Information about these three variables (decision making authority, teaching environment and quality of decision making) was collected from school councils (parents, teachers and principals) via questionnaire. Similarly, Gunnarsson et al (2009) investigated the

impact of degree of autonomy (in hiring personnel, budget allocation, curriculum design, students' evaluation and organizing extracurricular activities), parental participation (in school activities and children development) and school supplies on student achievement in eight Latin American countries. Besides in Philippines, the authors examined the impact of SBM interventions (such as teacher training and direct funding to schools) on students' test score (Khattari, Ling and Jha, 2010). Similarly, Vásquez (2012) compared the SBM schools with traditional public schools in Guatemala by comparing three resources: school material, teacher training and learning environment.

Finally, another factor for the ambiguous findings is the approach to collecting data to analyze the impact of SBM on student achievement. Perceptions of parents, teachers or principals have been explored through self-diagnostic questions which are subjective in nature (Gunnarsson et al 2009 in eight Latin American countries; Bandur 2008 in Indonesia; Di Gropello and Marshall 2005 in rural Honduras). These perceptions on various measures (such as decision making authority, teacher training and type of SBM) were compared with the test scores of students. Such an approach is indirect in nature and hence the results are ambiguous regarding the impact of SBM on students' achievement. One of the direct methods through which the impact of SBM on student achievement could possibly be measured is to look at the amount of funds allocated, expenditure incurred and the areas where the funds are spent; such as improvement in school facilities. This study is an attempt in that direction and analyzes the impact of budget allocation and expenditure on learning outcomes in Khyber Pakhtunkhwa Pakistan, the data for which has been collected from schools by visiting schools and inspecting the schools' condition.

The following sections discuss the datasets and variables used and methodology adopted to address the research question.

### Research Question, Data and Variables

As mentioned earlier, this study assess the association between PTC reforms and learning outcomes. The dependent variables are the rates of proficiency in three subjects – reading Urdu, reading English and mathematics – whereas the independent variables are measures of PTC reforms (timely availability of funds, funds spent, students' sitting arrangement<sup>2</sup>, students' attendance, parental involvement, school size/school enrollment, pupil-teacher ratio (PTR), mono/multigrade schools, school location, and school gender e.g. girls' only, boys' only and mixed schools). This research question was split into three parts: *Which factors related to PTC reform are associated with learning outcomes, namely: a) reading a sentence in Urdu; b) reading a word in English; and c) performing two-digit subtraction?*

In order to address this question, three data sources were used: a) EMIS (annual school census), which was obtained from the Ministry of Education KP, b) the Annual Status of Education Reports (ASER) about KP, generated from an NGO-sponsored household survey, and c) collection of primary data by conducting interviews from the headmasters of select public primary schools (those sampled in the EMIS and ASER databases).

The EMIS data source is a comprehensive database of all government schools in KP province, compiled by the Elementary and Secondary Education Department (E&SE). The E&SE department has administered a middle-of-school-year questionnaire to all the public schools in the province since 2001. Institutional coverage is excellent, with almost all public schools

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<sup>2</sup> This variable has been used because the schools were given autonomy to construct additional classrooms, if needed, from the PTC budget. Prior to this reform the schools were dependent on provincial government to construct additional classrooms. Hence, the linkages between classrooms and LOs were assessed.

returning questionnaires. Hence, data from the EMIS database provides a comprehensive picture of select aspects of public schools at provincial level. For the current study, the EMIS database for the year 2012 has been used. The integration of EMIS and ASER databases resulted in analysis of 361 public primary schools common in both the datasets in 23 districts of the KP province.

The ASER data source is a citizen-led, large-scale national household survey about the quality of education in rural and some urban areas of Pakistan. ASER has been collecting data about children's learning outcomes (age 5-16) in reading and arithmetic since 2010 in Pakistan. The ASER organization collected data from two districts in KP province in 2010, 14 districts in 2011 and 23 districts in 2012 (Annual Status of Education Report [ASER], 2012; ASER 2011). This research will analyze data collected by ASER from public primary schools in 2012. Two databases, ASER 2012 and EMIS 2012 have been integrated to answer the research question.

The third data source is primary data collected from a specially created survey questionnaire implemented in 222 public primary schools in KP (average 10 schools per district in 23 districts). The schools in which the questionnaire was carried out were selected from a list of 361 schools created from integrating the EMIS 2012 and ASER 2012 databases using EMIS school codes<sup>3</sup>. The questionnaire was filled by the head masters of public primary schools since they are authorized under the PTC Guide (2007) to operate the council's bank account as the secretaries-cum-members of the PTC<sup>4</sup>. The overall purpose of survey questionnaire was to collect information about the allocation and expenditure of PTC budget in order to understand the association between PTC and students' learning outcomes. Specifically, the survey captured information about: parental involvement, timely availability of funds, school items purchased, expenses incurred, and balance amount in the bank accounts of PTCs as well as detailed information about school facilities.

The information generated from the survey enabled a more detailed assessment of the effectiveness of PTC reforms. This information highlights areas most directly influenced by the implementation of PTC reforms such as: availability of PTC funds, the amount of funds spent, expenditure by type of commodities (classroom consumables, repair and maintenance and office consumables), total expenditure incurred, balance amount and parental involvement. This body of evidence, some of it qualitative, provides more nuanced accounts of the school-based factors influencing students' learning outcomes. Survey data, together with data collected from EMIS 2012 and ASER 2012 databases will help address the following research question: What aspects of PTC reforms (such as *timely availability of funds, funds spent, students' attendance, students' sitting arrangement, parental involvement, school size, pupil-teacher ratio (PTR), mono/multigrade schools, school location, and school gender e.g. girls' only, boys' only and mixed schools*) are associated with students' learning outcomes?

The dependent variable, learning outcomes, determines percentage learning assessment

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<sup>3</sup> ASER tested students from 420 public primary schools in 2012. The integration of EMIS 2012 and ASER 2012 databases, through EMIS codes, resulted in 387 public primary schools. The rest of the school codes were either missing or faulty (i.e. the EMIS codes were either less than or greater than five digits). A further analysis of data revealed that ASER assigned wrong EMIS codes to 26 schools. For example, EMIS codes of a school in district A was assigned to a school in district B. After deleting those schools, the data size was reduced from 387 to 361 schools. Out of these 361 schools, 232 schools were visited for collection of PTC data. The sampling approach is a simple random sampling approach. Based on the following criterion, ten to twelve schools per district were selected: 3 all-girls' schools, 3 all-boys' schools and 3 mixed schools (all-boys' schools having girls enrolled in them). However, an analysis of 222 schools have been conducted when it was found out that ASER assigned mismatched district codes to certain schools. The descriptive analyses of these 222 schools indicate that they are representative of the 361 schools in terms of school characteristics and school quality.

<sup>4</sup> Other members of the PTC council include: Chairperson (a parent of a child enrolled in the school), three members (parents of enrolled children), a notable person from the locality, a retired government official and an elected Councilor from the locality. The PTC Secretary and Chairperson are co-signatories and are authorized to operate the PTC bank account.

of children aged 5-16 having competencies in literacy & numeracy and is measured at the school level. Three learning outcomes were assessed by ASER based on a child having attained a specific proficiency level in Urdu, English and Arithmetic. Five proficiency levels in literacy and numeracy were measured. These levels are: a) reading beginner/ cannot read, b) reading letters, c) reading words, d) reading sentences, and e) reading a story. In order to reduce the number of variables for analysis, two proficiency levels - reading letter and word - were combined to make one level that is, read word or less. Hence, the number of variables was reduced from five to four. These new variables are as follows: a) a child cannot read, b) can read word or less, c) can read sentence, and d) can read story. Similar method was performed for the two other learning outcomes - English and Mathematics. For this study, children's learning outcomes were aggregated to the school level thereby assessing the percentage of children aged 5-16 enrolled in each public primary school who can read a sentence or less in Urdu, who can read a word or less in English and who can perform basic subtraction or less in arithmetic. This proficiency level has been discussed in detail in order to maintain uniformity across various analyses for each learning outcome, and because the results were meaningful and statistically significant. Hence, a variable Read-Urdu-Sentence 'RDURDSNT' is constructed to determine % of children who are able to read a sentence in Urdu. It is an interval level variable having values: 0 to 100. A variable Read-English-Word 'RDENGWRD' is constructed to determine % of children able to read a word in English. A variable MATH is constructed to determine % of children able to do 2-digit subtraction.

The set of independent variables used in this study refer to PTC reforms and school autonomy. This set includes variables such as: children's sitting arrangement, parental involvement, funds received, availability of funds on time, funds spent, school size, PTR (kachi-grades 2), PTR (grades 3-5), mono/multigrade school, school location (urban/rural), children's attendance and school type (girls' only, boys' only and mixed schools). These variables are measured at school level as well. The first variable, *sitting arrangements*, determines whether schools have enough classrooms. Three dummy variables have been created that indicate whether children have separate classrooms (1=yes, 0=no), Shared Classrooms (1=yes, 0=no) and/or are Without Classrooms (1=yes, 0=no). The second variable, *parents' involvement* is created by adding head masters' responses to two variables: whether the parents attend PTC meetings (1=always, 2=seldom, 3=never), and whether parents participate in school related activity (1=always, 2=seldom, 3=never). The third variable *funds received* is coded 1 if the school received funds in any of the three years for which the PTC data was collected and 0 if the school did not receive funds. Fourth variable, *timely funds* determines whether the school received funds on time in any of the three years for which the PTC data was collected. The dummy variable *timely funds*=1 indicates PTC funds were received on time in one of the three years while 0 indicates that funds were not received on time. The fifth variable *funds spent* determines whether the school spent the money (1) or not (0).

The sixth variable is school size SCHSIZE, which is an interval level variable that has been constructed from EMIS data of 2007 and 2012. School enrollment variable is created by summing enrollments from kachi/pre-primary to grade 5 (6 grades) in years 2007 and 2012. Using quartile approach, the sample of 222 schools has been grouped into small, small-to-medium, medium and large sized schools. SCHSIZE had a moderate positive skew hence it was transformed into Log (SCHSIZE). The seventh variable Pupil Teacher Ratio (PTR) estimates class size. Two interval level variables have been constructed; one for early grades (kachi-grade 2) and another for higher grades (grades 3-5). These variables are created in two steps. First, school enrollment (kachi- grade 2) variable is created by summing enrollments from kachi to grade 2. Second, PTR (kachi-2) is computed as:  $PTR = (\text{School enrollment (kachi- grade 2)} /$

number of teachers)\*100. Similar method has been adopted for the interval level variable PTR (grades 3-5). The eighth variable MULTIGRADE determines whether a teacher teaches two or more grades at the same time in the same classroom or space. This is a dummy variable where 1 represents multigrade school if a school has less than six teachers and 0 represents monograde schools if a school has more than six teachers.

The ninth variable URBRUR indicates the location of the schools. This variable has been coded into a dummy variable (0, 1) where 1 indicates urban schools and 0 indicates rural schools. The tenth variable, *children's attendance*, is a dummy variable indicating percentage of students' (90% or more) present during the day of school visit by the surveyors of PTC team. This variable has been constructed in two phases. First, the number of students present on the day of visit to schools in 2013 has been divided by total number of students in a school and the output is multiplied by 100. Then this variable has been dummy coded as one if students' attendance is greater than 90 and 0 if the attendance is less than 90. The last variable SCHGENDER=1-3 indicates boys' school, girls' school and mixed school (boys' school with girls enrolled in them) respectively.

### Methodology

As mentioned, the research question is: *what aspects of PTC reform are associated with better learning outcomes?* This analysis uses the data collected from 222 rural schools through PTC questionnaire, EMIS 2012 and ASER 2012 databases. Multiple regressions were conducted to examine whether *PTC reforms* (timely availability of funds, funds spent, students' sitting arrangement, students' attendance, parental involvement, school size, pupil-teacher ratio (PTR), mono/multigrade schools, school location, and school gender e.g. girls' only, boys' only and mixed schools) are related to learning outcomes, namely: *a) reading a sentence in Urdu; b) reading a word in English; and c) performing two-digit subtraction?*

As mentioned earlier, this paper uses an education production-function approach to examine the effect of "inputs" (PTC reform) on "outputs" (learning outcomes). Production Functions for PTC reform and learning outcomes is estimated as follows:

$$LO = F(PTC \eta) \quad (1)$$

LO stands for learning outcomes measured as the percentage of students who have achieved a given proficiency level in reading and mathematics. Consequently, separate models of three learning outcomes have been constructed. However, only one of the proficiency levels of these three learning outcomes is discussed here in detail to maintain uniformity across various analyses, to keep the discussion focused and because of the significance of the results. The specific learning outcomes refer to the following abilities: Reading a sentence in Urdu, reading a word in English and the ability to do two digit subtraction. Production functions are derived as follows:

$$RDURDSNT_i = PTC_i \alpha_1 + u_i \quad (2)$$

$$RDENGWRD_i = PTC_i \beta_1 + v_i \quad (3)$$

$$MATH_i = PTC_i \gamma_1 + w_i, \quad (4)$$

where RDURDSNT, RDENGWRD and MATH refer to percentage of children who are able to read a sentence in Urdu, read a word in English and do a 2-digit subtraction. Subscripts "i" represent schools whereas u, v and w, are error terms. The estimation of equations 1, 2, 3 and 4

are for public primary schools only. Thus, learning outcomes for children enrolled in private or other types of schools are not considered in this study. A multiple linear regression has been used to address the research question.

PTC is a vector of variables representing school autonomy reform, implemented by strengthening Parent Teacher Councils (PTCs). Variables included in PTC are: parental involvement (PRTINV), timely funds (TIMELYFUNDS), funds spent (FUNDSPENT), students' attendance (PRCNTCHILDRNATTENDANCE) children's sitting arrangement (SEPARATECR, SHARED CR), School size (SCHSIZE), PTR (kachi- grade 2), PTR (grades 3-5), mono/multigrade (MULTIGRADE), urban/rural (URBRUR), and school gender (SCHGENDER). The vectors  $\alpha$ ,  $\beta$  and  $\gamma$  are coefficients that measure the relationship between PTC practices on RDURDSNT, RDENGWRD and MATH. A multiple regression analysis have been conducted to examine the relative influence of each set of independent variables on learning outcomes. The multiple linear regressions require dependent variable to be continuous (Randolph and Myers, 2013; Heck, 2004) and in this equation the dependent variables - RDURDSNT, RDENGWRD and MATH - are continuous variables. Multiple linear regressions help in assessing the independent influence of independent variable (PTC) on the dependent variable (learning outcomes) (Alexopoulos, 2010; Lewis-Beck, 1980).

**Table 1. Summary Statistics of Independent Variables used in the Study**

Descriptive Statistics					
Variable	N	Minimum	Maximum	Mean	Std. Deviation
Multi-Grade School	361	0	1	.72	.448
Total Classrooms	344	0	20	4.40	3.077
PTR for grades Kachi-2	361	5	106	25.62	12.723
PTR for grades 3-5	361	0	57	19.02	8.414
Children's Attendance	222	0	100	83.90	20.304
Parents PTC participation	222	1.00	3.00	1.3423	.64514
Parents School participation	222	1.00	3.00	1.3694	.65809
PTC Funds Received on time	222	0	1	.62	.487
PTC Funds Spent	222	0	1	.93	.259
Valid N (list wise)	161				

Before running regressions, few variables such as PTR and number of teachers were transformed to extract meaningful information. Instead of using the 'number of teachers' per se, a new variable 'multigrade schools' was constructed to indicate whether schools have at least one teacher for each grade level or otherwise. Similarly, the variable PTR was split into PTR at two levels (kachi class to grade 2 and grade 3 to grade 5) because the data analysis revealed high rates of dropout in early grades (kachi-grade 2). In relation to PTC reforms, 'timely funds' supersedes the importance of 'funds received', and thus it was decided not to include the latter variable in the equation. Similarly, the variable 'total number of classrooms' was excluded while a related variable 'grade-based children's sitting arrangement' was included as it more closely depicts the shortage of classrooms by indicating for which grade levels separate classrooms are available, which grades share classrooms and which grades sit in the open air or are without classrooms. Other variables were excluded based on a similar decision making process. Finally, twelve out of seventeen variables related to PTC reforms were selected for inclusion in the regression equation. These variables include: school size, PTR (katchi- grade 2), PTR (grades 3-5),

multigrade schools, timely funds (PTC funds provided on time), funds spent, separate classrooms versus no classrooms, shared versus no classrooms, parents' participation in PTC and school related activities, children's attendance, school location, and school type (girls' only, boys' only and mixed schools). The summary statistics of these variables are presented at Table 1.

## Results

Multiple linear regressions have been run to assess the association between PTC Reforms (timely funds, funds spent, children's sitting arrangement, parental involvement, school size, PTR, multigrade schools, students' attendance, rural schools, and school gender) and the rates of proficiency at each of the four proficiency levels in each subject area (Urdu, English and Mathematics). However, the results of only third proficiency levels (reading sentence in Urdu, reading words in English, and performing two-digit subtraction) are discussed here in order to maintain standardization across various analyses, and because the results were meaningful and statistically significant<sup>5</sup>.

As reported in Table 2 (columns 2 and 3) the variables *school size*, *children's sitting arrangement* and *children's attendance* show a significant relationship with children's ability to read a sentence in Urdu. The overall model explains 6 percent of variance in the rates at which students were proficient in reading, which was statistically significant ( $R^2 = 0.063$ ,  $F=2.12$ ,  $p < .05$ ). The results indicate that a one unit increase in school size/school enrollment was related to approximately 17 point decrease in percentage of children who can read a sentence in Urdu. The multivariate analysis also found that schools with children sitting in separate classrooms had higher the percentages of children who can read a sentence in Urdu (approximately 9 percentage points) compared to schools that lacked classrooms. Similarly, schools in which children shared a classroom with children from other grades had reading proficiency rates nearly 8 percent points higher than schools without classrooms. The results also indicate that in schools in which children's attendance is greater than 90 percent, the percentage of children who can read a sentence in Urdu was nearly 4 percentage points higher than those schools in which children's attendance is less than 90%.

As mentioned earlier, no studies to my knowledge exist that have assessed the impact of school size, children's sitting arrangement and children's attendance on students' learning outcomes. However, having said that only one of these three variables can be traced in the literature if we could broadly classify children's sitting arrangement (number of classrooms) as a school resource. The evidence on the impact of school resources/materials/facilities on children's learning outcomes is mixed. In Latin American countries school supplies shortage (textbooks, classroom lighting, temperature, hygiene, security and acoustics) negatively affect language and mathematics test scores (Gunnarsson et al, 2009). On the other hand, Vásquez (2012) found no impact of school materials (chalk, paper, markers and poster board) on the test scores of third and fourth graders in Guatemala. The study conducted by Bandur (2008) found that SBM in primary schools resulted in increase in student achievement in reading, mathematics, sports and local agriculture skills. However, the increase in test scores happened along with other changes happening at the same time; one of which was better school facilities and teaching aids. A general conclusion arising from these studies is that various school resources have a different impact on students' performance.

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<sup>5</sup> In addition to running regressions for all four proficiency levels for each subject an alternative method was also used to verify the findings. This method is used by New York State for rating schools. The NYS combines the four proficiency levels into one performance index (PI) which is calculated as follows:  $PI = ((Level2 + (Level3*2) + (Level4*2))/Sum(Levels 1 to 4))*100$ . The findings of these two methods are nearly similar.

The second component of the research question assessed the association between PTC reform variables and children's mathematics skills. Three variables, *school size*, *PTR (grades 3-5)* and *multigrade schools* are found to be significant predictors of numeracy skills. The overall model explained 1 percent of variance in students' numeracy skills. Specifically these results indicate that a one unit increase in school size/school enrollment is related to 17 percent decrease in percentage of children who can perform subtraction (Table 2 columns 4 and 5). The regression results also indicate that a one unit increase in the PTR for grades 3-5 is related to a 0.39 increase in the rate that children can do subtraction. In multigrade schools, the rate at which children can perform subtraction is 8 percentage points lower than in monograde schools, in which there is at least one teacher per grade level.

The third component of the research question focused on *which PTC reform variables influence children's English reading skills*. Several variables - *school size*, *PTR (grades 3-5)* and *multigrade school* - show a statistically significant relationship with the children's ability to read a word in English. The overall model explained 0.1 percent of variance in English reading skills, which was not statistically significant ( $R^2 = 0.001$ ,  $F = 1.01$ ,  $p = 1.10$ ). The specific results indicate that a one unit increase in school size is related to a 22 percentage point decrease in percentage of children who can read a word in English. Also a one unit increase in PTR in grades 3-5 is related to a 0.47 percentage point increase in the rate that children read a word in English. In multigrade schools, the rate of children's ability to read a word in English decreased by 11 percentage points as compared to monograde schools, in which there is at least one teacher per grade level. As mentioned there is limited empirical literature that have assessed the linkages between PTC reform variables and children's learning outcomes and hence there is a need to further research on the subject.

## Discussion

The study hypothesized that the PTC reform, which decentralized financial authority and delegated autonomy to schools, may have an influence on children's learning outcomes. The data analysis showed that of all the variables in PTC reforms category children's sitting arrangement had a positive and significant association with their ability to read a sentence in Urdu. Other variables in this category (timely transfer of funds, funds spent and parental involvement) had no association on any of the three learning outcomes. The insignificance of two variables - fund spent and parental involvement - can be explained by the fact that more than 90 percent schools in the dataset spent the money during the same years for which the budget was provided. Hence, a very small percentage of schools that did not spend the funds were not representative to yield any effect on literacy skills. Similarly, the dataset revealed that more than 80 percent parents were always involved in PTC activities and hence the rest of the dataset may not be representative to yield any effect on literacy skills. This finding is in contrast with the research conducted by Gunnarsson et al (2009) that found significant impact of parental involvement on language test scores in Latin American countries. Another variable in this study - timely transfer of funds - was not found statistically significant because of the high percentage of schools in the dataset that received funds on time.

The analysis also revealed that school size was significantly negatively associated across all three learning outcomes (read a sentence in Urdu, read a word in English and perform two-digit mathematics). The finding is consistent with Salfi and Saeed's (2007) findings from Pakistan, which observed that small schools performed better than medium and large secondary schools. Increase in school size means increase in school enrolment, which means increased teacher workload and little attention to the learning needs of students from socially marginalized

communities. Also, increase in school size may necessitate the need for more teachers, more classrooms and more teacher training in classroom management and pedagogy.

**Table 2. Multivariate Analysis of PTC Reform on Learning Outcomes**

Variable	Dependent Variables <sup>#</sup>					
	Percentage Children Who Can Read Sentence in Urdu		Percentage Children Who Can Do Subtraction		Percentage Children Who Can Read Word in English	
	B	$\beta$	B	$\beta$	B	$\beta$
Timely Funds	2.340	.069	3.750	.103	-.033	.000
Funds Spent	.440	.007	1.376	.020	2.777	.036
Separate Classroom	9.154	.273**	1.117	.031	-4.324	-.107
Shared Classroom	7.861	.238*	2.292	.064	-3.181	-.080
Parent's Participation	4.810	.106	-4.959	-.102	-.075	-.001
School Size (Log)	-16.864	-.341**	-17.450	-.328**	-22.467	-.376**
Pupil-Teacher Ratio (grades Kachi-2)	-.047	-.037	-.134	-.097	.081	.053
Pupil-Teacher Ratio (grades 3-5)	-.053	-.027	.394	.185**	.474	.198**
Multi-Grade School	-3.628	-.100	-8.248	-.211**	-11.569	-.263**
Rural School	1.768	.018	2.947	.027	7.341	.060
Children's Attendance	3.839	.116*	1.253	.035	1.834	.046
Girls School	1.073	.022	1.851	.034	-.564	-.009
Mixed School	-.787	-.023	.788	.022	-1.130	-.028
(Constant)	41.005		55.805		22.93	
<i>n</i>			222			
Adjusted R <sup>2</sup>	.063		0.010		0.001	
F	2.11**		1.162		1.01	

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .05$ ; \*  $p \leq .10$ .

# For measurement of these variables refer to Annex-I.

The analysis further revealed that monograde schools and PTR (grades 3-5) were positively associated with two learning outcomes (subtraction and reading a word in English). International evidence in this regard is mixed and inconclusive. Some researchers found that students have better achievement in multigrade classes (McEwan, 2008; Lloyd, 2002; Aina, 2001; Ong, Allison & Haladyna, 2000) while others found no difference in student learning (Cornish, 2009; Gerard, 2005; Little, 2004). Still some other found negative impacts of multigrade education on student achievement (Kirby and Mariano, 2009; Willms and Somers, 2001; Mason & Burns, 1996). However, the inconclusive findings are due to the presence or absence of various factors such as specialized teachers' training, nature of curriculum, supply of learning materials and assessment types.

The study also shows that PTR (grades 3-5) is positively associated with two learning outcomes (subtraction and reading a word in English). This finding is consistent with that of Willms and Somers's study (2001) in Latin American countries that found significant positive

effects of PTR on grade 3 and 4 students' language and math test scores. The variable children's attendance was found to have a positive impact on learning Urdu. The result lend support to the handful of recent studies that found positive and statistically significant relationships between student attendance and academic achievement in numeracy, reading and writing (Hancock, Shepherd, Lawrence and Zubrick, 2013; Gottfried, 2009). The finding makes sense especially for poor children attending public schools as they are less likely to have resources at home, which are necessary to make up for the loss of class time. Ironically, however, students' attendance had no statistically significant relationship with doing subtraction and reading a word in English. Further research is required to explore the relationships. Also, school location and school type were found to have no impact across all three learning outcomes.

### **Limitations and Conclusion**

Few researchers have investigated the relationship between children's learning outcomes and PTC reform in terms of budget allocation, infrastructure improvement, teacher hiring and parental participation, particularly in Pakistan. Khyber Pakhtunkhwa province presented a suitable context to pursue the question of how PTC reform influence children's ability to read a sentence in Urdu, read a word in English and perform two-digit subtraction. The reforms were unique in a sense that it resulted in various interventions in public schools such as: increase in non-salary budget per classroom per annum, opening of PTC bank accounts by all public schools, transfer of budget directly to the PTC bank accounts, timely availability of budget, need based spending, teacher hiring, introduction of third-party audit thus replacing traditional bureaucratic audit, exempting PTC budget from being lapsed; restructuring of PTC composition, formulation of PTC functions and ensuring community participation. Hence, it was imperative to assess the linkages between PTC reform and children's learning outcomes.

Before discussing the main findings of the study, it is imperative to discuss the limitations of this study. First, the integration of ASER and EMIS datasets resulted in a small sample size, 361 schools, out of which the researcher could visit only 222 schools (10 sample schools per district) due to time and financial constraints. There may be a probability that with a larger provincially representative data beyond this sample that was collected by ASER and ultimately a larger sample size to address current research question my findings may look slightly different. However, while I mention the limitations of data it must be noted that this is the only current dataset available on learning outcomes in Khyber Pakhtunkhwa, Pakistan. Besides, this is the only study that could be carried out because in future no such studies can be conducted by integrating EMIS and ASER datasets due to the non-availability of EMIS codes in later versions of ASER datasets. Another limitation is that the various proficiency levels in literacy and numeracy represent the simple tasks the children can perform. However, these learning levels could be considered as the most appropriate proxies of the more complex cognitive outcomes that could be produced by effective use of school resources.

Having noted these limitations, the study reveals few important trends that I believe make a valuable contribution to the ongoing conversation on the devolution of autonomy to schools in Pakistan and other South Asian countries. First, the data analysis showed that separate classrooms improve the ability of students to read a sentence in Urdu. This is an important policy finding in general because no such specific study to my knowledge exist before. The finding is important in the context of Pakistan as well because according to the Elementary and Secondary Education Department's (E&SE) Report 2012, fifty percent public schools in KP province consist of two classrooms instead of the requisite six classrooms, which means shortage of classrooms is affecting children's literacy skills. Hence, this finding highlights the importance of separate classrooms for better educational outcomes. The second important finding pertains to school

size/school enrollment. The research on the effects of school size is an emerging field in the OECD countries, however, much of the focus of the researchers is on high schools. This study reveals that school size is significantly negatively associated across all three learning outcomes - read a sentence in Urdu, read a word in English and perform two-digit subtraction.

The third major finding relates to multigrade schools – schools where less than six teachers teach all six grades. The study reveals that multigrade schools have a negative association with children’s ability to do subtraction and read a word in English. The fourth research finding concerns positive association between high pupil-teacher ratio in grades 3 to 5 and students’ ability to do subtraction and read a word in English. A likely explanation of this pattern is that children learn subtraction in early grades and hence an increase in PTR in grades 3-5 may have little impact on children’s ability to do subtraction. Furthermore, as mentioned earlier, the dataset revealed that the PTR decreases in higher grades due to high dropout in early grades (kachi-grade 2), and that can be another plausible explanation for the finding. Finally, the study revealed that the number of days a student was present in school positively affected children’s ability to read a sentence in Urdu.

The findings of this study provides vital policy input to the Government of Pakistan in particular and other developing countries in general. The issues addressed in this study are common, to a larger extent, among the South Asian countries and other underdeveloped and developing countries. The study reveals that PTCs have key impacts on learning outcomes, school productivity and return on public sector educational investment thus providing impetus for further strengthening of PTC and community participation.

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## **Annex-I: Operationalization of Variables**

*Table 2: Multivariate Analysis of PTC Reform on Learning Outcomes*

The Dependent Variables have been computed as:

- a) The variable ‘percentage children who read sentence in Urdu’ has been calculated by dividing the number of children who can read a sentence in Urdu by total number of children sampled minus number of children who were not tested in Reading Urdu. The output was multiplied by 100.
- b) The variable ‘percentage children who can do subtraction’ has been calculated by dividing the number of children who can do subtraction by total number of children sampled minus number of children who were not tested in Mathematics. The output was multiplied by 100.
- c) The variable “percentage children who read word in English” ‘ has been calculated by dividing the number of children who can read a word in English by total number of children sampled minus number of children who were not tested in reading English. The output was multiplied by 100.

The Independent Variables have been computed as:

- a. School size (Log): Log of number of children enrolled in schools in 2012.
- b. Pupil-Teacher Ratio (grades Kachi-2): sum of children enrolled from Kachi to grade 2 divided by number of teachers and multiplied by 100.
- c. Pupil-Teacher Ratio (grades 3-5): sum of children enrolled in Grades 3 to 5 divided by number of teachers and multiplied by 100.
- d. Multigrade: 1 refers to a school where the number of teachers is less than six indicating at least one multigrade class; all other schools (with 6 or more teachers) are defined as 0.
- e. Timely Funds: 1 indicates PTC funds were received on time in one of the three years while 0 indicates that funds were not received on time.
- f. Funds Spent: 1 indicates PTC funds were received on time while 0 indicates that funds were not received on time.
- g. Sitting Arrangements: Three dummy variables have been created that indicate whether children have separate classrooms (1=yes, 0=no), Shared Classrooms (1=yes, 0=no) and/or are Without Classroom (1=yes, 0=no).
- h. Parent’s Participation: 0 represents no participation and 1 represents parents’ participation.
- i. Rural: 1 refers to a rural school; 0=Urban school.
- j. Children’s Attendance: 1 represents students’ attendance is greater than 90% and 0 represents less than 90% attendance.
- k. Girls school = 1 refers to a girls’ school; 0=others
- l. Mixed school = 1 refers to a mixed school (boys’ school with girls’ enrolled); 0=others

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