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Looking Beyond the Household: The Importance of School Factors in Understanding Elementary Grade Retention in Rural Khyber Pakhtunkhwa, Pakistan

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Looking Beyond the Household: The Importance of School Factors in Understanding Elementary Grade Retention in Rural Khyber Pakhtunkhwa, Pakistan
Regarder au-delà du foyer : L'importance des facteurs scolaires afin de comprendre la rétention dans les classes primaires dans la ville rurale de Khyber Pakhtunkhwa, Pakistan

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Abstract

This paper contributes to the limited literature on the educational outcomes of children in rural Khyber Pakhtunkhwa (KP), Pakistan. It explores the impact of school-level factors such as physical resources, teachers and school characteristics on retention to the last grade of primary in the KP province for the time period 2007–12. Two sources of data were used to measure the retention rates. One of which is an official compilation of institutional data on education known as Education Management Information System (EMIS). The second data source, Annual Status of Education Reports (ASER), is a household data set with a rich set of household covariates, teachers' characteristics and student performance data on reading and mathematics. The results from regression analyses indicate that children are more likely to complete primary education cycle when they receive instructions in local language and when the pupil-teacher ratio is below a certain threshold. Results also reveal that a continuous increase in school size beyond a certain threshold (> 400 enrollment) is related to a decrease in retention rate. Further, mixed schools (all-boys' schools having girls enrolled in them) were found to have better retention rates than boys' schools.

Résumé

Cet article ajoute à la littérature limitée sur les résultats scolaires des enfants dans la région rurale de Khyber Pakhtunkhwa (KP), en Pakistan. Il explore l'impact des facteurs scolaires tels que les ressources physiques, les enseignants et les caractéristiques de l'école, sur la rétention scolaire jusqu'à la dernière année de l'école primaire dans la province de KP durant la période allant de 2007 à 2012. Deux sources de données ont été utilisées pour mesurer les taux de rétention. L'une d'entre elles est une compilation officielle de données institutionnelles sur l'éducation, connue sous le nom de Système d'Information de Gestion de l'Éducation (SIGE). La deuxième source de données, les Rapports Annuels sur le Statut de l'Éducation (RSAE), est un ensemble de données sur les foyers avec un riche ensemble de covariables des foyers, et de données sur la performance des élèves en lecture et en mathématiques. Les résultats des analyses de régression indiquent que les enfants ont plus de chance de compléter leur cycle d'éducation primaire quand l'instruction se fait dans la langue locale et quand le ratio élève-enseignant en-deçà d'un certain seuil. Les résultats révèlent également qu'une augmentation continue de la taille de l'école au-delà d'un certain seuil (> 400 inscriptions) est liée à une diminution du taux de rétention scolaire. De plus, il se trouve que les écoles mixtes (écoles pour garçons seulement ayant des filles inscrites) ont de meilleurs taux de rétention que les écoles de garçons.

Keywords: Pakistan, student retention, school resources, rural primary schools, developing countries

Mots-clés : Pakistan ; rétention des élèves ; ressources scolaires ; écoles rurales primaires ; pays en voie de développement

Introduction

It is estimated that 7 million children do not attend school in Pakistan, and of that number, two thirds are girls. Of the children who are able to attend school, a large percentage unfortunately leaves school early. In 2010, only 60% of boys and 58% of girls eventually reached Grade 5, the final grade of primary education (Academy of Educational Planning and Management [AEPAM], 2011). A comparison with other South Asian countries reveals that in Pakistan the retention rate—

percentage of children who survive to the last grade of primary education (typically Grade 5)—is the lowest in the region.

A comparison of education indicators across the four provinces in Pakistan indicates that these patterns are especially prevalent in one of Pakistan's poorest and most conflict-affected provinces, Khyber Pakhtunkhwa (KP). According to UNICEF Report (2011a), 3 million children do not attend school in KP, out of which 2 million are girls. The literacy rate in KP province is 50% compared to the national average of 58% (Pakistan Social and Living Standards Measurement Survey [PSLM], 2010–11). Women continue to be a particularly disadvantaged group, as compared to men in the KP province. The literacy rate among women is much lower (33%) than men (68%). Additionally, only half of the children (51%) go to primary schools in the province (45% of girls and 57% of boys) and almost half of these children drop out before completing Grade 5 (PSLM, 2010–11). The goal of universal primary education remains elusive, as half of the children drop out of school before completing the primary education cycle (Kachi/Pre-Primary to Grade 5). Low retention rate also impacts many other areas of educational growth. Besides, scarce public and human resources are not maximized where children drop out of school without learning basic skills such as reading, writing, and numeracy before completing primary education (Warwick & Reimers, 1995).

Given the bleak educational statistics, it is imperative to discern which school-level factors influence retention rates among children in primary schools in the context of the KP province. To address this question, this paper adopted a multi-component research design, which takes into account the unique characteristics of the KP province and the constraints of data availability.

Theoretical Framework

Empirical research has identified a number of factors—individual, household, school, and system-level factors—that predict dropout. While considerable attention has been paid to the individual and household-level factors that contribute to children leaving school (Brown & Park, 2002; Hunt, 2008; Lewin & Sabates, 2010; Morara, 2009; Pridmore, 2007; Reddy & Sinha, 2010; Sabates, Akyeampong, Shindler, 2010; UNESCO, 2010a; Westbrook, & Hunt, 2010), little attention has been drawn to contributing systemic factors that lead to increased dropouts in developing countries. Systematic factors consist of educational policies such as supply of schools, school location, fee, and school resources, which originate at the level of state decision making. These decisions play a crucial role in pulling students in or pushing students out of the education system (Branham, 2004; Lloyd, Mensch, & Clark, 2000; Lloyd, Mete, & Grant, 2009).

It is assumed that once a child enters schools, he or she will receive high quality education and will progress smoothly through the system. This review digresses from these oft-cited reasons and situates low retention rates in the context of systematic factors that fail to maximize support to children attending school. The argument is that literature has fallen short in examining the ways in which the education system contributes to students leaving school early. I argue that there is a critical need to focus on redesigning the education system, which in many developing countries is implicitly structured to push students out of the system. An education production-function approach has been used to examine the effect of "inputs" (school-level factors) on "outputs" (retention to the last grade of primary). According to the education production function, students' retention as the educational output will be affected by various school-level factors, perceived as inputs.

The underlying argument of education production function is that schools are like factories, which produce learning using inputs such as teachers, materials and financial resources. However,

economists argue that education systems are more complicated than factories where decision makers have the discretion to optimally choose inputs for their firm. In educational setups, two most important inputs are students and parents, the qualities of whom differ in every setting, and thus the decision maker (government in current scenario) has no control on the selection of these two inputs. Besides, unlike factories where production process depends on inputs in one point of time, in educational setups, the production process (i.e., educational outcomes, which are long-term consequence of schooling, e.g., achievement scores, attendance rates and retention to the last grade of primary) depends on a series of inputs over time; for example, quality of teachers in previous class, availability of resources in schools, parents' attention and availability of library (Glewwe, Hanushek, Humpage, & Ravina, 2011).

A substantial body of research in high and low income countries has examined the linkages between school-level factors and students' educational outcomes using production-function model (Willms & Somers, 2001; Alderman, Orazem, & Paterno, 2001; Hanushek, Lavy, & Hitomi, 2008; Glewwe et al., 2011; Lee & Zuze, 2011). Based on the theoretical framework used by Lee and Zuze (2011), school-level factors have been categorized into physical resources, teachers and school organization, as illustrated in Figure 1 and discussed in detail in the following section.

Figure 1: Factors Affecting Retention to the Last Grade of Primary Education (Pre-Primary– Grade 5)

Conceptual Framework for Retention to the Last Grade of Primary
Source: Modified version of framework used in Lee and Zuze (2011).

Literature Review

A wide range of literature related to school participation and its impact on dropout exists (Lloyd et al., 2000; Handa, 2002; Branham, 2004; Admassu, 2011). However, the topic of the impact of school-level factors on retention to the last grade of primary in developing countries is under-researched. Retention to the last grade of primary measures the capacity of an education system to retain students from first grade of primary education (Pre-Primary/Kachi) to final grade of primary education (typically Grade 5). Retention is a superior measure compared to other educational indicators such as enrollment, attendance and transition because if a child is able to complete primary education cycle (Grade 5), this means he has surpassed these three indicators successfully.

Based on extant literature, variables conceptualized as school-level factors can be categorized into school physical resources, teachers, and school characteristics based on the typology used by Lee and Zuze (2011). Physical resources can be further categorized using a typology developed by Lloyd et al. (2000) into infrastructure (school building, classrooms, sport facilities, science labs,

and library), instructional materials (desks, chairs, blackboards, and textbooks), and amenities (toilets, electricity, and drinking water).

Physical Resources

A substantial body of research indicates that provision of an environment conducive to learning is essential for effective education (Shadreck, 2013, Hussain, Salfi, & Khan, 2011; Lloyd et al., 2009; Branham, 2004; Lloyd et al., 2000). One such indicator of the learning environment in school is the availability and state of physical resources such as school infrastructure, instructional materials and amenities**.** Many studies have shown that the quality of schools in many developing countries is deplorable (e.g., overcrowded classrooms, classrooms without electricity, fans and blackboards, and labs without lab equipment) (Lavy, 1996; Case & Deaton, 1996; Filmer, 2008; Chapman & Adams, 2002; Sengupta & Guha, 2002; Singh & Sridhar, 2002). Yet, literature concerning the impact of physical resources on retention is sparse as the focus of the emerging scholarship is on the impact of physical resources on learning outcomes. Only few studies have examined linkages between physical resources and retention rate (Lloyd et al., 2000; Branham, 2004; Lloyd et al., 2009).

Using the typology proposed by Lloyd, Mensch and Clark (2000), physical resources are categorized as school infrastructure, instructional materials and amenities. This typology will be used in the following section to frame the extant research.

School Infrastructure. The limited research available on the impact of infrastructure (school building, classrooms, sport facilities, science labs, and library) on retention is inconclusive. Studies conducted by Lloyd, Mensch and Clark (2000) in Kenya, and Lloyd, Mete and Grant (2009) in Pakistan found no explicit linkages between dropping out and material resources. However, a study conducted by Branham (2004) in Houston, Texas found positive impact of infrastructure on attendance and retention. The study found that students were less likely to attend schools that were in need of repair (such as repair of electrical systems, roofing, flooring, and glass repair). The study also found that a school using temporary buildings, as compared to a similar school that did not use temporary buildings, lost more than one student per day.

Instructional Materials. Limited research examines the impact of instructional materials on retention, although considerable research has been conducted on the impact of instructional materials on learning outcomes. Existing studies on retention have examined the impact of either one resource (e.g., blackboard) in a category (instructional materials) or a number of resources (e.g., chair, desk, drinking water and toilets) from various categories (e.g., instructional materials and amenities). One such study by Warwick and Reimers (1995) found that unless schools have textbooks, chalks, and blackboards, teaching and learning would be difficult. Another study by Admassu (2011) estimated the impact of school factors on primary school enrollment and dropout in Ethiopia. The author found that parents' perception of poor physical facilities, such as shortage of classroom chairs and lack of drinking water and toilets, results in double dropout rate in rural areas. Instructional materials also seem to affect access to schools. A study by Hazarika (2001) in rural Pakistan found that having blackboards in primary schools is positively associated with girls' enrollment. However, the study found no impact of blackboard on boys' enrollment.

Amenities. Quantitative studies on the effect of amenities (toilets, electricity, and drinking water) on access and retention are sparse and the results are inconclusive. For example, a study by

Hazarika (2001) in rural Pakistan found that a local school with its own water supply has comparable effects on girls and boys' enrollment. In contrast, Lloyd, Mete and Grant's research (2009) in rural Pakistan indicated that higher school amenities (water, toilets, electricity and furnished schools) are not a significant factor in reducing the probability of girls' dropout from public and private primary schools. Similarly, Grant, Lloyd and Mensch's study (2013) on menstruation and school absenteeism in rural Malawi found no association between girls' school attendance and female toilets availability or provision of sanitary supplies.

To sum up the above analysis, common sense dictates that physical resources (school condition, instructional materials and amenities) should be important determinants of educational outcomes; however, this proposition is controversial in the literature for developing countries. The literature review reveals a mixed relationship between school condition and availability of amenities on dropout and a positive impact of availability of instructional materials on enrollment and retention.

The following section discusses other two categories of school resources—teacher and school characteristics—based on the typology used by Lee and Zuze (2011).

Teachers

Teachers' absence and shortage are significant in schools in low and middle income countries; however, research on this issue has not received a great deal of attention in developed countries, as western scholarship has focused on factors that lead to the provision of high quality teachers. Teachers' absence and shortage cause two problems. First, it results in loss of instructional time, which means limited opportunities for learning (Benavot & Limor, 2004; Abadzi, 2009). Second, in instances where the only teacher in the school is asked to teach all the classes, it becomes difficult to manage students' activities properly. As a result, students don't take interest in their studies; they remain absent and leave the school.

Various studies have looked at the prevalence of teachers' shortage in schools (Alcazar, Rogers, Chaudhury, Hammer, Kremer, & Muralidharan, 2006; Banerjee & Duflo, 2006; Ghuman & Lloyd, 2010; Colclough, Rose, & Tembon, 2000), yet there is little research linking teacher shortage to dropout. With research that is available, it has explored the perceptions of students, teachers, or parents on dropout (Admassu, 2011; Hussain et al., 2011) instead of analyzing official education data of the government. These studies found that shortage of teachers and poor teaching methods reduce the odds of child enrollment and retention. An exception to these studies was a natural experiment conducted in India through which an additional teacher was provided to primary schools where there was only one teacher. The study found that the intervention increased girls' primary completion rate by 3–4 percentage points and literacy by 2–3 points (Chin, 2005).

School Characteristics

There is considerable debate in the research community on the extent to which school characteristics (pupil-teacher ratio, school size, location and type of school, multigrade teaching, school fee, and school shifts) contribute to retention. This issue has been widely debated with respect to two features: location (urban/rural) and pupil-teacher ratio.

Urban/Rural Locations. Several studies have found that rural schools are less likely to retain children, particularly girls, as compared to urban and semi-urban schools (Warwick & Reimers, 1995 in Pakistan; Sengupta & Guha, 2002 in India; Muwanika, 2008 in Uganda; Lloyd et al., 2009 in Pakistan; Hussain et al., 2011 in Pakistan). There are a number of possible reasons for this

trend. First, households in rural areas tend to be poorer. Second, schools in rural areas are far away from many children's home and of poor quality. Third, members of the households are less educated and their value on education is lower, particularly with regards to girls' education. Fourth, due to less education, parents often enroll their children at an older age. Fifth, transportation is relatively less developed which makes long-distance travel difficult.

One of the factors that contributes to children dropping out from rural schools is that children often have to travel long distance, sometimes across difficult terrain. Research by Hussain et al. (2011) in Pakistan and Muwanika (2008) in Uganda found that students in rural schools are more likely to drop out as compared to their counterparts in urban areas due to poor means of transportation. Another factor that contributes to dropout from schools in rural areas is teachers' shortages, especially of trained teachers. In Malawi, for example, average pupil-teacher ratio is 46:1, while in rural areas the ratio is as high as 81:1 (Mulkeen, 2009). Similarly, in Uganda, regions affected by conflict have pupil-teacher ratios of 90:1 as compared to the national average of 45:1 (Pôle de Dakar, 2009). In Pakistan, there is only one male teacher for 81 students across the country in rural areas (AEPAM, 2013). Mulkeen (2009) observed that the Ugandan capital district had 60% trained teachers whereas the rural districts had only 11% trained teachers. Mulkeen and Chen (2008) in their study found that such regional disparities resulted in high repetition, dropout, and poor test scores.

Pupil-Teacher Ratio (PTR). In addition to the location of school, class size is also found to be an important determinant of child schooling. Muwanika (2008) examined the effect of school factors on retention in Uganda. The research found that higher pupil to teacher ratios (PTR) was associated with lower retention rates. Similarly, Marshall (2011) analyzed school dropout and academic failure over four years in rural Guatemala. The study found that a higher standard deviation in class size (about eight more students) increases the odds of dropout by about 1.7 times. Similarly, a multi-level analysis in 30 developing countries showed higher enrollment of girls and boys associated with smaller class size in primary schools (Huisman & Smits, 2009).

Overall this literature review highlights several significant issues. Although research has shown that school-level factors are important determinants of children's education outcomes, very few studies have focused on the relationship between school-level factors and retention throughout the primary grades especially in Pakistan and Khyber Pakhtunkhwa Province (Ali, Hussain, Khan, Rafiqullah, & Rehman, 2011; Din, Dad, Iqubal, Shah, & Niazi, 2011; Hussain et al., 2011; Khan, Azhar, & Shah, 2011).

Research Question, Data and Variables

Based on this review of literature, I investigated the following question: *Which school-level factors are most strongly related to differences in retention among children in primary schools in the KP context?* Two sources of data have been compiled and analyzed in order to investigate this question. These sources are: (1) Education Management and Information System (EMIS), an official compilation of institutional data on education; (2) the Annual Status of Education Reports (ASER) produced from NGO-directed household surveys.

The dependent variable, retention rate to the last grade of primary, is measured at the school level. The dependent variable refers to the percentage of children in each school who are retained or who survive to the last grade of primary education (i.e., Grade 5). The school retention rate is computed by dividing the total number of Grade 5 enrollments in year ($y + 6$) by the total number

of enrollments in the pre-primary grade (Pre-Grade 1) in year (*y*). The percentage is obtained by multiplying the proportion by 100 (Mehta, 2007).

The set of independent variables used in this study refers to an array of school-level variables that are grouped into three categories: physical resources, teachers, and school characteristics. Guided by the literature, physical resources were grouped into infrastructure (number of classrooms), instructional materials (desks and chairs), and amenities. However, due to insufficient and incorrect EMIS 2012 data in the first two categories, these variables were dropped. The last variable, amenities, was constructed by adding five basic items in a school: electricity, drinking water, boundary wall, toilets, and useable toilets. The first four amenities were categorical variables, having two values; 1 = yes and 2 = no whereas the last variable, useable toilets, which reflected the number of useable toilets in schools, was a continuous variable. I first recoded the four amenities from 1, 2 to 0 and 1 where 0 represents no amenities and 1 represents the availability of an amenity. Then I recoded the variable, useable toilets, into a dummy variable where 1 represents schools having one or more useable toilets and 0 represents no useable toilets. Then I summed up all 5 amenities to construct an ordinal variable, amenities, which has values from 0–5 where 0 presents no amenities and 5 presents availability of all five amenities.

Four variables captured teachers' characteristics: teachers' education (graduate and master's) and teachers' professional qualification—Bachelor and Master in Education (BEd and MEd). This data was retrieved from the ASER 2012 data set. The variable *TeacherEdGrad&Master* was constructed by summing the number of teachers having a bachelors and a master's degree. This variable is divided by the total number of teachers in the school, and the resultant variable is multiplied by 100 to construct an interval level variable *%TeacherEdGrad&Master*. Similar method was adopted for teachers' professional qualification, BEd and MEd.

To account for school characteristics, seven variables were constructed from the EMIS 2012 data set: school location (urban/rural), school gender (girls', boys' or mixed schools), medium of instruction, school size, PTR (Kachi-2), PTR (3–5) and multi-grade schools. The variable school location had two values where 1 indicates urban schools and 2 indicates rural schools. This variable has been coded into a dummy variable (0, 1) where 1 indicates urban schools and 0 indicates rural schools. The second variable, school gender, has been constructed because officially in KP province the schools are strictly segregated and labeled as boys and girls' school only which is accordingly reflected in EMIS. Hence, a variable school gender (*SCHGENDER*) was created having values from 1 to 3 where 1 indicates boys' schools, 2 represents girls' schools and 3 refers to mixed schools (boys' schools with girls enrolled in them). The third variable, medium, indicates the medium of instruction in schools. It has three values: Urdu = 1; Pashto = 2; and English = 3. A dummy variable (0, 1) was constructed where 1 represents the medium of instruction as Urdu or English and 0 represents Pashto medium schools.

The fourth variable school size (SCHSIZE) is an interval level variable that has been constructed from the students' enrollment data 2012. The school enrollment variable was created by summing enrollments from Kachi to Grade 5. SCHSIZE had a moderate positive skew hence it was transformed into Log (SCHSIZE). The fifth variable in this category, 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, the school enrollment (Kachi–Grade 2) variable was created by summing enrollments from Kachi to Grade 2. Second, PTR (Kachi–2) was computed as school enrollment (Kachi–Grade 2)/number of teachers multiplied by 100. Similar method has been adopted for the interval level variable PTR (Grades 3–5). The last 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 a multigrade school if a school has less than six teachers and 0 represents monograde schools if a school has more than six teachers.

In total, 15 independent variables were initially proposed for this study: school gender, school location, amenities, medium of instruction, school size, pupil-teacher ratio (Kachi–2), pupil-teacher ratio (3–5), multi-grade schools, physical resources (number of classrooms), instructional materials (desks and chairs), teachers' attendance, teachers' academic qualification (matric and intermediate; graduate and master's) and professional qualification (Primary Teaching Certificate [PTC] and Certificate of Teaching [CT]; BEd and MEd). Out of these 15 variables, eight variables were selected for analysis as explained in the following section.

Methodology

As mentioned, the research question is: *What school factors influence retention to the last grade of primary?* To answer this question, this analysis has been performed for 361 public primary schools in 23 districts of the KP province by integrating the ASER 2012 database with the EMIS 2012 database through EMIS codes. The estimation was performed at the school level using school level variables (physical resources, teachers and school characteristics). As mentioned earlier, this paper uses an education production-function approach to examine the effect of "inputs" (school-level factors) on "outputs" (retention to the last grade of primary). Production functions for school-level factors and retention is estimated as follows:

$$\text{Retention}_{\text{(to the last grade of primary)}} = F\,(\text{PHYRES, TEACHER, SCHCHAR}, \eta)$$

where PHYRES, TEACHER and SCHCHAR represent school physical resources, teacher and school characteristics. INFRASTR, INSTRMAT, AMENITIES are physical resources (PHYRES) included in the production functions. Vector TEACHER consists of teacher characteristics, i.e., teacher academic qualification and professional qualification. Variables included in the school characteristics (SCHCHAR) are SCHLOC, SCHSIZE, PTR (Kachi–2), PTR (Grades 3–5), and multigrade A multiple linear regression analysis was conducted to examine the relative influence of each set of independent variables on retention. The multiple linear regressions require dependent variable to be continuous (Randolph and Myers, 2013; Heck, 2004) and in this equation the dependent variable, retention to the last grade of primary, is a continuous variable. Multiple linear regressions help in assessing the independent influence of each independent variable (physical resources, teacher and school characteristics) on the dependent variable (retention) (Alexopoulos, 2010; Lewis-Beck, 1980). Multiple linear regression analysis has been used for comparison of three group coefficients (all girls', all boys' and mixed schools). The equation is as follows:

$$\text{Retention}_{\text{(to the last grade of primary)}} = a_0 + b_1X1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_{5\,+}\, e$$

where a_0 represents intercept or constant. The coefficient b is referred to as the slope while e represents presence of error (Lewis-Beck, 1980).

Before running regressions, diagnostic tests such as tests on linearity, normality and collinearity were performed on the independent variables to address major assumptions of regression model (de Vaus, 2002). Tests for linearity and normality were conducted to meet the first assumption. The scatter plots and histograms indicated that several of the independent variables required transformations. For example, the variable, school size, had a moderately positive skew. Hence, a log transformation was performed to make the distribution normal and a new variable "*Log School size*" was created (de Vaus, 2002).

The pattern of correlation among independent variables was examined to check the second regression assumption, that is, the absence of collinearity between the independent variables. The results from the collinearity analysis are exhibited in (Table 1 and 2). It is observed from Table 1 that the Variance Inflation Factor (VIF) value for teachers with lower professional qualification (PTC and CT) and higher professional qualification (BEd and MEd) was greater than 5, hence one of the academic qualifications (PTC and CT) was omitted. As evident from Table 2, after omitting teachers' lower academic and professional qualification and retaining higher academic and professional qualification, all independent variables have relatively low tolerance and the resulting VIF values do not exceed the cutoff value 5.

Table 1: Collinearity Diagnostics (School Factors)
Coefficients [a]

Independent variables		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	16.004	23.965		.668	.505		
	Rural	-13.504	9.514	-.064	-1.419	.157	.929	1.076
	Medium of instruction (Urdu)	-5.503	3.075	-.085	-1.790	.074	.843	1.187
	Amenities	.290	.933	.015	.311	.756	.783	1.277
	Total classrooms	-.132	.617	-.013	-.214	.830	.545	1.835
	School size (Log 2012)	26.088	8.323	.263	3.134	.002	.270	3.705
	Multigrade	2.842	4.704	.040	.604	.546	.425	2.354
	PTR for Grades Kachi–2	-.914	.131	-.368	-6.973	.000	.681	1.469
	PTR for Grades 3–5	1.828	.224	.473	8.163	.000	.566	1.767
	Percent teacher's attendance	-.037	.049	-.033	-.751	.453	.971	1.030
	Percent teacher BEd & MEd	-.031	.149	-.024	-.208	.835	.148	6.740
	Percent teacher grad & master's	-.007	.030	-.011	-.245	.807	.919	1.089
	Percent teacher PTC & CT	-.089	.137	-.072	-.650	.516	.156	6.402
	Percent teacher matric & intermediate	.021	.041	.025	.517	.605	.817	1.224

a. Dependent variable: Retention07_12

After checking for regression assumptions, a few variables were eliminated from the regression equation for the following reasons. Teachers' academic and professional qualification and teachers' attendance were eliminated from the regression equation because of (a) insufficient and incorrect data, and (b) the coefficients were not significant for the regression equation between school factors (2012) and retention 2007–2012.

The variables 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) for two reasons. First, the impact of PTR, as an interval-level variable, was found to have a weak impact on retention. Then, a dummy variable was used to test whether retention is particularly sensitive to large-class sizes (above 40). The results showed no significant effects. Further analysis of retention rates for different grade-levels revealed that the class-size effect is a product of schools retaining comparatively fewer children in later grades (Grades 3–5), with resulting large classes and high rates of early dropout (Kachi–Grade 2) (Marshall, 2011). Hence, the PTR was split into two variables: PTR (Kachi–Grade 2) and PTR (Grades 3–5).

The pattern of correlation between the two variables, PTR (Kachi-Grade 2) and PTR (Grades 3–5), was examined to check the regression assumption—that is, the absence of collinearity between the two independent variables. The results from the collinearity analysis are exhibited in Table 3. As it indicates, while the two PTR variables are positively correlated with each other ($r = .412$), only PTR (Grades 3–5) is positively correlated with retention (.482) while PTR (Kachi–Grade 2) is essentially zero (-.077). When put in the model together, the PTR (Kachi–Grade 2) becomes significantly negative, suggesting that PTR (Grades 3–5) has a suppressor effect on the relationship between PTR (Kachi–Grade 2) such that the bivariate correlation is zero. In other words, holding constant PTR at the higher grades, smaller PTRs at lower grades are positively related to retention. Thence, the two tables, Table 2 along with Table 3, indicate that there is no issue of collinearity between the two PTRs and retention to the last grade of primary school.

Table 2: Collinearity Diagnostics (School Factors Excluding Teachers' Lower Academic and Professional Qualification)

Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	9.759	20.688		.472	.637		
	Rural	-13.403	9.492	-.064	-1.412	.159	.930	1.075
	Medium of instruction (Urdu)	-5.620	3.043	-.087	-1.847	.066	.857	1.167
	Amenities	.352	.928	.019	.379	.705	.789	1.268
	Total classrooms	-.157	.615	-.015	-.255	.799	.547	1.829
	School size (Log 2012)	25.478	8.272	.257	3.080	.002	.272	3.674
	Multigrade	2.562	4.678	.036	.548	.584	.428	2.337
	PTR for Grades Kachi–2	-.906	.130	-.365	-6.951	.000	.687	1.456
	PTR for Grades 3–5	1.815	.223	.470	8.153	.000	.570	1.754
	Percent teacher's attendance	-.036	.049	-.032	-.734	.464	.973	1.028
	Percent teacher BEd & MEd	.043	.060	.033	.717	.474	.915	1.093
	Percent teacher grad & master's	-.007	.030	-.011	-.246	.806	.924	1.082

a. Dependent Variable: Retention07_12

Table 3: Collinearity Diagnostics PTR (Kachi–Grade 2), PTR (Grades 3–5) and Retention Rate 2007–12)

Correlations

		PTR for Grades Kachi–2	PTR for Grades 3–5	Retention 07_12
PTR for Grades Kachi–2	Pearson Correlation	1	.412**	-.077
	Sig. (2-tailed)		.000	.147
	N	361	361	359
PTR for Grades 3–5	Pearson Correlation	.412**	1	.482**
	Sig. (2-tailed)	.000		.000
	N	361	361	359
Retention 07_12	Pearson Correlation	-.077	.482**	1
	Sig. (2-tailed)	.147	.000	
	N	359	359	359

** Correlation is significant at the 0.01 level (2-tailed)

After these initial analyses and decisions, eight out of 15 independent variables related to school-level factors were selected for the regression equation. These variables included: school location (urban/rural), amenities, medium of instruction, school size, pupil-teacher ratio (Kachi–Grade 2), pupil-teacher ratio (Grades 3–5), multigrade schools, and school type (girls' only, boys' only, and mixed schools). The summary statistics of these eight school-quality variables are presented at Table 4.

Table 4: Summary Statistics of Independent Variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Number of amenities	361	0	5	3.30	1.780
Teacher's attendance	361	0	100	84.59	28.565
Multigrade 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
Medium of instruction (1=Urdu, 0 = Pushto)	361	0	1	.60	.490
Children's attendance	222	0	100	83.90	20.304
Valid N (listwise)	161				

Results

As mentioned, the research question focused on the impact of school facilities upon retention to the last grade of primary in girls', boys', and mixed schools. Table 5 reports the regression coefficients of the eight independent variables related to the school facility on retention rates. The sample included 361 schools. The school-level variables selected for analyses are physical resources (amenities), teachers (mono/multigrade schools), and school characteristics (school location, school size, PTR, medium of instruction, and school type). The dependent variable is retention to the last grade of primary school.

In terms of physical resources, the variable, an index of amenities, did not have a statistically significant relationship with retention during the time period 2007–12. The overall model explained 41% of variance in students' retention to the last grade of primary. Besides, the variable related to teachers' category indicating number of teachers in a school—multigrade schools—did not significantly predict retention rates.

With regards to school characteristic variables, the analysis reveals that five out of six variables—school size, PTR (Kachi–2), PTR (3–5), medium of instruction, and school type—show a statistically significant relationship with retention to the last grade of primary for the time period 2007–12. The first key finding relates to school size. The multivariate analyses indicate that a one standard deviation increase in log of school size yields an increase of 0.30 standard deviation in retention rates to the last grade of primary school in the time period 2007–12. However, in order to verify whether the results hold for all school sizes, a curve estimation graph

was plotted between the log of school size and retention (2007–12). The graph, presented at Figure 2 shows that the rate of retention increases with increase in the size of school and reaches the highest point for schools having up to 400 enrollments (categorized as large schools) and starts declining beyond that.

The second key finding concerns pupil-teacher ratios. The analysis indicates that a one-unit increase in the PTR in the lower grades (Kachi–Grade 2) reduces retention rates by 0.89 percentage points in 2007–12. Surprisingly, in the higher grades a one-unit increase in the PTR (in Grades 3–5) increases retention rates by 1.6 units (i.e., percent). In order to further analyze to what extent an increase in PTR affects retention, a curve estimation graph was plotted between PTR (Grades 3–5) and retention (2007–12). The graph indicates that the relationship between PTR and retention is curvilinear, that is, higher PTR, up to 40 enrollments, is related to higher retention rates**,** after which retention starts declining as is presented in Figure 3. As mentioned earlier, one of the distinctive features of this study is categorization of PTR into PTR (Kachi–Grade 2) and PTR (Grades 3–5) whereas the extant research has assessed the impact of PTR in one or two elementary grades on dropout.

The third key finding is about medium of instruction. Controlling for the other variables, when Urdu (national language) is the medium of instruction in a school, instead of Pashto (local language), the retention rate tended to be lower by 5.122 percentage points. The fourth key finding concerns school type. The multivariate analysis indicates that mixed schools show a statistically significant relationship with retention for the time period 2007–12. This can be explained partially from the findings of descriptive analysis which showed that mixed schools under study had better qualified teachers, better children's attendance and better sitting arrangements, and in part through the interviews with the headmasters who stated that parents especially that of girls (primary level) enroll their children in mixed schools where they see the teaching and learning environment is better.

Finally the last variable, school's location (rural schools) did not show any statistically significant differences relative to urban schools, which may be due to the fact that most of the schools were rural schools (96%) in the data set and thus the number was not representative to yield any effect on retention. In summary, the data analysis revealed that five out of six school characteristics variables (school size, PTR in lower and upper grades, medium of instruction and school type) were statistically significant in determining schools' rates of retention to the last grade of primary school. Amenities, school location and multigrade schools did not predict retention.

Table 5 - Multivariate Analysis of Retention Rates to the Last Grade of Primary School (2007–12)

Dependent Variable: Retention Rate to the last grade of Primary (2007–12) #

	Retention 2007_12	
	Unstandardized Coefficients	Standardized Coefficients
Independent Variables	*B*	Beta
Physical resources		
Number of amenities	.977	.054
Teachers		
Multigrade school	3.891	.054
School characteristics		
Medium of instruction-Urdu	-5.122	-.077*
School size (Log)	30.173	.309***
Pupil-Teacher ratio (Kachi–Grades 2)	-.895	-.351***
Pupil-Teacher ratio (Grades 3–5)	1.674	.433***
Rural school	-11.027	-.050
Girls school	-.320	-.003
Mixed school	6.352	.095**
(Constant)	-9.868	
N	361	
Adjusted R^2	.39	
F	26.63***	

*** p ≤ .001; ** p ≤ .05; *p ≤ .10.

The retention rate refers to the number of students enrolled in Grade 5 in 2012 as a percentage of the number of students who were enrolled in the pre-primary grade (Kachi) in 2007.

NOTES:

a. Rural: 1 refers to a rural school; 0 = Urban school.
b. Number of amenities in school: a five-point scale summing five nominal variables indicating the existence of five amenities: electricity, drinking water, toilets, boundary wall and useable toilets. 5 = all five amenities, 0 = no amenities.
c. Medium of instruction-Urdu: 1 refers to a school in which the medium of instruction is Urdu; 0 = Pashto.
d. School size (Log): Log of number of children enrolled in schools in 2012.
e. Pupil-Teacher ratio (Grades Kachi–2): sum of children enrolled from Kachi to Grade 2 divided by number of teachers and multiplied by 100.
f. Pupil-Teacher ratio (Grades 3–5): sum of children enrolled in Grades 3 to 5 divided by number of teachers and multiplied by 100.
g. 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.
h. Girls' schools = 1 refers to a girls' school; 0 = others
i. Mixed schools = 1 refers to a mixed school (boys' school with girls' enrolled); 0 = others

Figure 2: Curve Estimation Model—School Size and Retention to the Last Grade of Primary School (2007–12)

Model Summary and Parameter Estimates

Dependent Variable: Retention07_12

Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	.138	57.296	1	357	.000	42.482	.086	
Logarithmic	.213	96.412	1	357	.000	-38.719	19.544	
Inverse	.192	85.032	1	357	.000	72.972	-1476.417	
Quadratic	.184	40.154	2	356	.000	29.814	.215	.000

The independent variable is TotalEnrollment—2012.

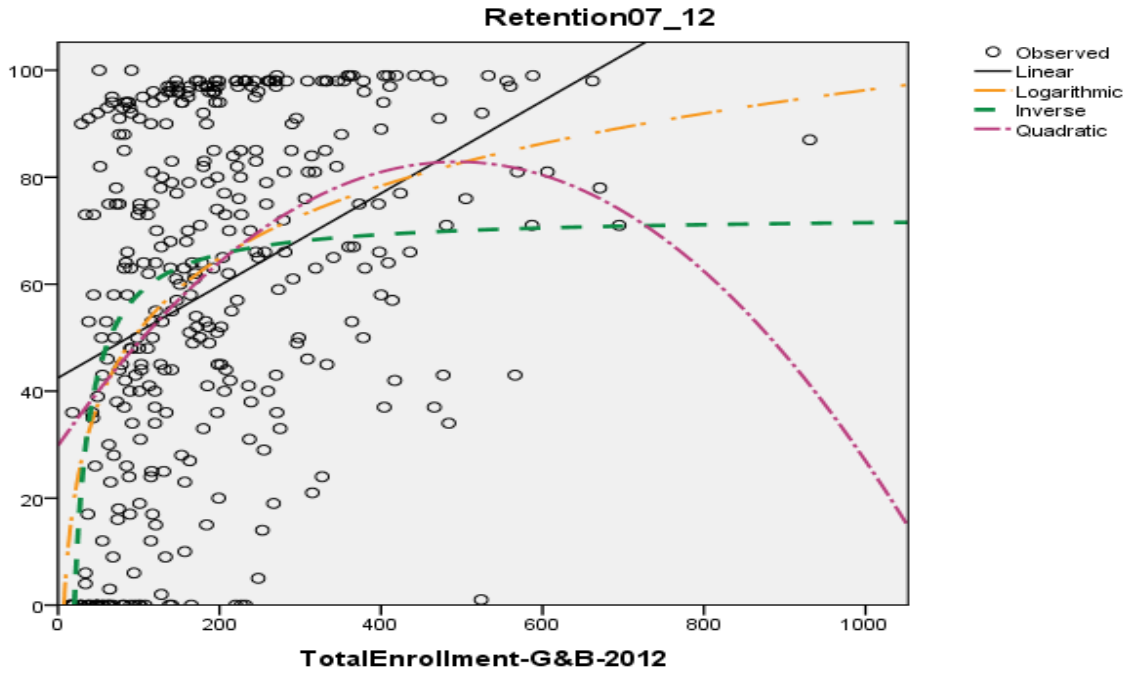


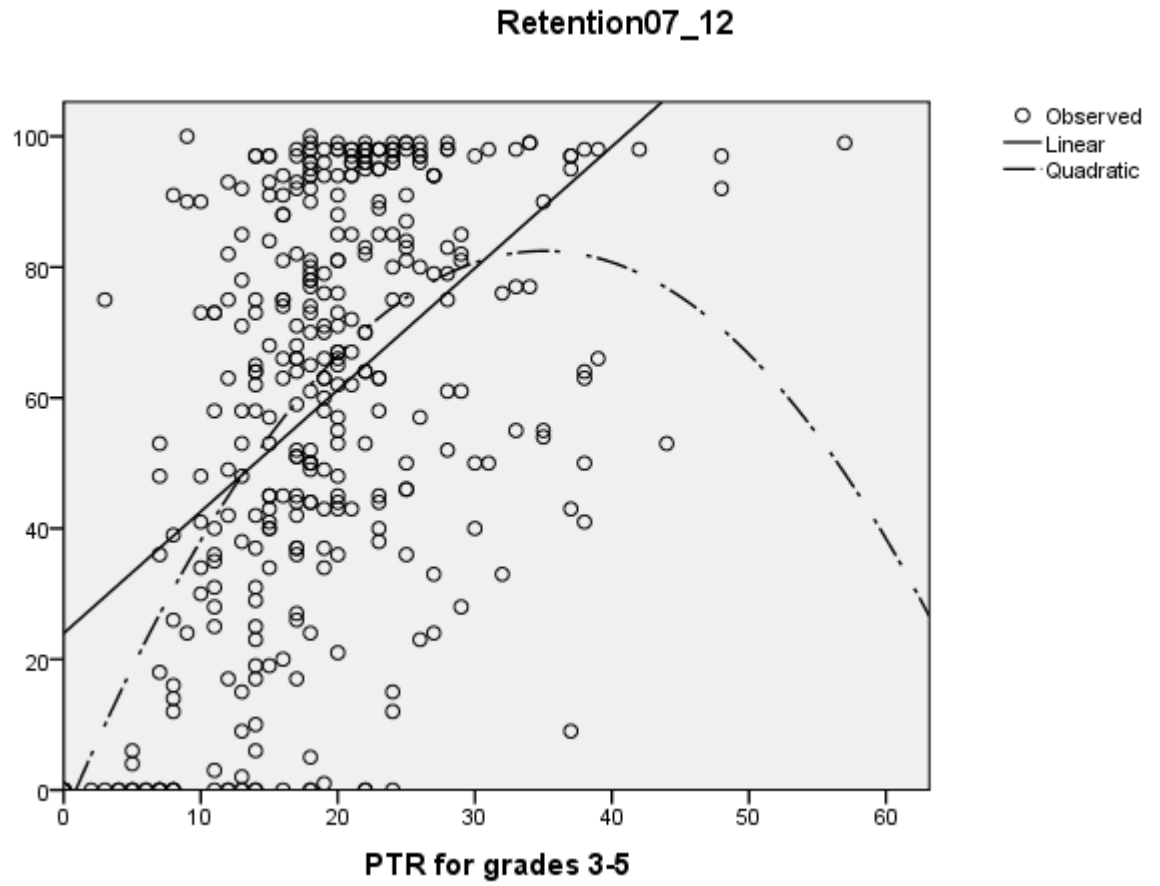
Figure 3: PTR (Grades 3–5) and Retention to the Last Grade of Primary School

Model Summary and Parameter Estimates

Dependent Variable:Retention07_12

Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	.232	107.816	1	357	.000	23.970	1.862	
Quadratic	.307	78.878	2	356	.000	-4.297	4.952	-.071

The independent variable is PTR for Grades 3–5.



Discussion

This study explored the impact of school-level factors on retention rates to the last grade of primary with the argument that school factors are an important determinant of pulling children in or pushing children out of public education system. The study reveals several important conclusions. First, the analysis shows that retention rates to the final grade of primary education are significantly increased when the medium of instruction is local language (Pashto) instead of national language (Urdu). The finding is consistent with existing empirical studies on the subject, which show that the best medium of instruction for the early grades is the language a child already knows, and to which a child is naturally exposed in his/her social environment (Ahmed, 2013; Guiab, Palting, & Sario, 2014; Fakeye, 2011; UNICEF, 2011b; UNESCO, 2010b; Benson, 2005; Cummins, 2001). These studies further argue that as a child develops conceptual knowledge in his language, it enables him to better grasp and gain proficiency in another language. In addition, these studies also indicate that children who learn in native languages actively participate in the classroom, stay longer in school, do better on tests, and repeat grades less often than students who do not get instruction in familiar language. In the context of KP province, the policy finding has an immense importance because medium of instruction has been a contentious and divisive issue in Pakistan and especially in KP province for quite a long time. The indecisiveness of the KP governments can be gleaned from the fact that the medium of instruction has been changed four times since 2000–2014 in the province from mother tongue (Pashto) to Urdu to mother tongue again and to English despite the fact that according to the 1998 Census Report, nearly 77% population of the province speaks Pashto language whereas only 0.2% people speak Urdu. Hence, the policy finding that teaching children in mother tongue improves retention rate makes a valuable contribution to the ongoing conversation on the medium of instruction in Pakistan.

The second important finding pertains to pupil-teacher ratios (PTR). The study reveals that high pupil-teacher ratios in Kachi–Grade 2 have significant impacts on reducing retention rates to the final grade of primary education. This finding is supported by existing literature, which shows that higher class size increases the likelihood of school dropout (Muwanika, 2008; Case & Deaton, 1996). High pupil-teacher ratio reflects shortage of teachers and this empirical study demonstrates the need to hire more teachers to reduce the likelihood of early school dropout so that almost all the children can complete primary education cycle in KP. The enrollment statistics in KP indicate that children are at higher risk of dropping out in early grades especially from Pre-Grade 1 to Grade 2; this finding makes a valuable contribution to the current debate on high dropout in early grades. Conversely, the study finds that high pupil-teacher ratios in Grades 3–5 have a positive impact on retention. This finding may refer to the presence of a more positive classroom environment, as found by Willms and Somers (2001). However, further research is required to assess the relationship between PTR in Grades 3–5 and retention rate to the last grade of primary.

The third major finding relates to school size. The study reveals that the rate of retention increases with an increase in school size, up to a certain threshold (400 students), and then decreases with further increase in school size. No research has been conducted on the impact of school size and retention to the last grade of primary school and further research is required to assess the mechanisms involved. The emerging literature in developed countries has focused on dropout in high schools (Werblow & Duesbery, 2009; Crenshaw, 2003) and it is unclear whether research findings regarding high school size can be generalized to include elementary schools.

Finally, the study reveals that mixed schools have higher retention compared to boys' only and girls' only schools. This is an interesting finding because in KP province schools are segregated as girls and boys' schools. The need to create the third category "mixed schools" was

felt when it was observed that in some boys' schools, significant numbers of girls were also enrolled. The reason provided by the head teachers was that girls attend boys' schools when there are no girls' schools nearby, or when the parents perceive that the teachers' attendance in boys' schools is better than that of girls'. This viewpoint was confirmed from the findings of descriptive analysis which showed that mixed schools have better qualified teachers, better children's attendance and better sitting arrangements. This choice indicates a shift from current social and cultural norms that would influence parents' decision to enroll their daughters in girls' only primary schools. This information would be useful for formulating policies that would create an official third category of schools (other than all-boys and all-girls) and address the issue of financial resource constraints due to which the province is not being able to construct the required schools for girls. Such policies may mitigate the shortage of girls' schools in KP province to a certain extent. However, further research is needed to better understand improved retention in mixed schools.

Conclusion

Proponents of free education believe that abolishing fee structures will result in expanding educational access, improving efficiency and achieving equity of opportunity. However, as this study demonstrates, provision of free education does not guarantee that a child will progress smoothly through the education system and will complete primary education cycle. There are various school-level factors that contribute towards pushing children out of education system such as teaching a child in a language other than his/her mother tongue, higher pupil-teacher ratio, school size and school type.

When children from poor families are taught in a foreign language in public schools, they face difficulty in understanding the lessons and cannot actively participate in the classroom; as a result, they drop out from school. This finding contributes to existing research on the importance of teaching in mother tongue in early grades, which can guide policy makers in KP province to reconsider their decision about medium of instruction. Besides, children from poor household require more individual attention from teachers in early grades than children who can get additional support at home in terms of having books and receiving private tuition. Higher pupil-teacher ratio in early grades restricts a teacher to teach effectively and bring innovation in teaching. Hence, children lose interest in schooling and drop out early, which is evident from the higher dropout rates in KP province. The policy findings are supported by existing literature on dropout and there is a need to reduce class size especially in early grades.

Mixed primary schools (boys' school with girls enrolled in them) is not an official category in Khyber Pakhtunkhwa; however, it is interesting to find out that the retention rates are better in mixed schools than all-boys or all-girls schools. This unusual finding can be supported by the observation that the mixed schools were better resourced. However, further research is required to assess the mechanisms involved. This study also finds that a continuous increase in school size is related to a decrease in retention rate. No prior research on the subject exists; however, the existing literature that assessed the relationship between school size and students' achievement supports the findings of existing research.

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