# Exploring the Impact of Resource Inequity on Student Performance in Pakistan – A Temporal Analysis

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## Abstract

*In the wake of the global learning crisis, the present study explores the concept of resource inequity and its consequential impact on student performance in Pakistan. To achieve this end, it incorporates both, the demand-side and supply-side educational resources and evaluates their impact on proficiency in literacy and numeracy, utilizing nationally representative cross-sectional microdata collected by the National Education Assessment System (NEAS). The focus of the study is on Grade 4 students who appeared in the National Assessment Test (NAT) in 2008 and 2016, allowing us to conduct a temporal analysis of the results. The dataset is comprised of 11,943 students from 2008 and 13,004 from 2016. For empirical estimation, multiple linear regression analysis is performed. The findings have highlighted that teachers' conduct in the classroom consistently emerged as the most influential factor in its association with student performance. School infrastructure, easy access to school, socio-economic environment around a student, students' conduct at home, along student engagement in co-curricular and extra-curricular activities also significantly improved student performance. The study has concluded that supply-side educational resources have a stronger impact on student performance than demand-side educational resources. These insights offer practical guidance for policymakers to develop strategies addressing both immediate and long-term challenges in Pakistan's education system, aiming to improve student performance and ensure educational resource equity.*

## 1.    Introduction

The global learning crisis has resulted in 250 million children out of school and an estimated 70% of children in developing countries being unable to read and

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write a simple text by the age of 10 (UNESCO, 2023). The issue is even more severe in the case of developing countries such as Pakistan. In Pakistan, 26.2 million children (39%) of school-age children are out of school (PIE, 2022) and 43 million children (77%) who are enrolled in schools are suffering from learning poverty (Pakistan Learning Poverty Brief, 2022). Learning poverty is defined as the inability to read and write basic text by the age of 10. At the primary level, half of the fifth graders, which is 51%, cannot read a story written for second graders and 66% cannot solve basic subtraction problems (ASER, 2023). As a result, Pakistan's Learning Adjusted Years of Schooling (LAYS) stands at approximately 5.1 years (Pakistan Learning Poverty Brief, 2022), suggesting that the students enrolled in grade 9 have a learning level of only 5 years of quality-adjusted schooling.

The reason why it is urgent to address the learning crisis is that a great body of research stresses that deficiencies in literacy and numeracy skills developed in the early years of schooling significantly hinder students' long-term ability to understand and engage with course content throughout their academic careers (Leigh and Thompson, 2008; Johnson and Parker, 2009). This eventually manifests in compromised student performance, perpetuating a cycle of learning as well as overall poverty (Geven, 2019). In this context, the presented education statistics are alarming, and their impact threatens the future of Pakistan and necessitates a need to thoroughly investigate the crisis.

The contributing factors behind the learning crisis in Pakistan are complex, however, the crisis largely stems from spatial and demographic inequity in terms of the availability of educational resources available to students (Supianto et al., 2023; Zreik, 2023). This inequity of resources can be further categorized into two types: demand-side educational resource inequity and supply-side educational resource inequity. For instance, in Pakistan, the student-teacher ratio is 39 students per teacher at the primary level, compared to the global practice of 15 to 21 students per teacher (Pakistan Education Statistics Highlights Report; 2020-21). Additionally, 30% of schools lack electricity, 22% of schools do not have access to water at the primary level, 21% do not have boundary walls and 21% of schools do not have access to toilets (Pakistan Education Statistics Highlights Report; 2020-21). This shortage of essential resources severely compromises the quality of education and the learning environment, making it difficult for students to achieve their academic potential.

The issue of resource inequity is not only confined to supply-side educational resources but demand-side as well. For instance, many students, especially those from weaker socio-economic backgrounds face challenges that

extend beyond the classroom i.e. only 24 percent of children from the lowest income quartile in Pakistan can read a simple story in Urdu, compared to 43 percent from the highest income quartile (ASER, 2023). Among the country's 4th graders, only 27% meet low international benchmarks in mathematics (TIMSS, 2019).

Previous studies have largely studied supply-side and demand-side educational resources separately. The present study in this regard fills this critical gap by thoroughly examining the relationship between both types of resources and student performance in Pakistan. It also analyzes how this relationship has evolved from 2008 to 2016 by comparing the cross-sectional microdata. This comprehensive approach not only offers academic insights but also on the public policy front in terms of helping educators develop more inclusive evidence-based strategies.

The contribution of the present study is that it categorizes educational resources into demand-side and supply-side resources based on a thorough review of the literature and incorporates them into one model intending to explore how they interact to influence student performance. The key research objectives this study aims to explore are:

- Analyze the role of demand-side educational resources in determining student performance in Pakistan.

- Analyze the role of supply-side educational resources in determining student performance in Pakistan.

- Compare the data from two distinct periods such as 2008 and 2016 to evaluate changes in the influence of demand-side and supply-side educational resources on student performance.

Based on these research objectives, the study tests the following hypotheses:

$H_0^1$: Demand-side educational resources are not associated with student performance.

$H_0^2$: Supply-side educational resources are not associated with student performance.

$H_0^2$: The impact of education demand-side and supply-side resources on student performance remains constant over time.

Despite education being universally recognized as a fundamental human right and being upheld in key international declarations like the Universal

Declaration of Human Rights[3] (1948), the Dakar Framework of Action (2000)[4], international initiatives like the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), the learning crisis persists. This further emphasizes the significance of universal and equitable education for all. SDG4 specifically aims at ensuring inclusive and equitable quality education by 2030. However, 9 years past the launch of SDGs, the global and local education statistics present a grim situation as discussed in the introduction section.

In Pakistan, Article 25-A of the constitution mandates free and compulsory education for children aged five to sixteen, reflecting Pakistan's commitment to this global right but the prevalent learning crisis constantly reminds us to redevise targeted interventions and evidence-based education policies. Several NGOs are assisting the government to the educational needs of the schools and citizens but since the crisis is interwoven with educational resource inequity, it is important to explore the dynamics of the resource inequity to address the root causes on a much larger scale. Addressing educational resource inequity in Pakistan is critical to overcoming barriers to quality education and promoting equitable access, ultimately breaking the cycle of poverty and fostering sustainable development.

## 2.    Review of Literature

This section presents the analysis of the current body of literature to learn from the methodological approaches that have been used in those studies, identify both the demand-side and supply-side educational resources the literature has explored, and eventually build up a theoretical and methodological framework around this.

The role of school infrastructure has been highlighted as an important driver of student performance in literature. Earthman's (2002) study highlighted the negative effects of inadequate school facilities such as overcrowded classrooms and lack of basic facilities on student learning and dropout rates. The study used a longitudinal design to evaluate the impact of facility conditions on student performance over time. Findings concluded that a better school building condition positively impacts student performance, while a poor condition negatively affects it.

These findings were later confirmed by a study by Varthana (2023) as well, as the author emphasized the significant role of school infrastructure in shaping educational outcomes and overall student development. It has highlighted that

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[3] which asserts the right to free elementary education
[4] which aims to ensure all children, especially marginalized groups, have access to quality primary education

while curriculum design, teaching quality, and institutional reputation are essential for achieving educational goals, the availability of the physical environment of schools such as buildings, classrooms, laboratories, and equipment is equally important. The study stressed that quality infrastructure supports effective teaching and learning processes and contributes to lower dropout rates by creating a conducive learning environment. The study also highlighted the importance of safe and healthy school environments for students' physical and emotional well-being.

In order to analyze the role of teacher training and professional development in enhancing teaching quality and effectiveness, the study by Darling-Hammond and Youngs (2002) offered valuable insights. The study critically argued about the proposition that a teacher's qualification is an indicator of teacher performance in the classroom. The authors argued that while effective teaching is important and recruiting people with higher degrees as teachers can guide the state education policy in reality, teachers' certificates and degrees do not guarantee effective teaching and learning in the classroom. The study challenged the preconceived notion and highlighted the importance of teacher training programs as a key determinant of student performance.

In 2005, Sirin's study evaluated the relationship between the socioeconomic background of students and their learning outcomes. For this purpose, the data was collected by conducting a meta-analytic review of the literature and the findings confirmed the existence of a strong association between better socio-economic background and improved learning outcomes. Similarly, Heyneman (2003) and Okioga (2013) particularly explored the challenges faced by students from low socio-economic backgrounds. The data collection methodologies for both of these studies involved conducting a survey that inquired questions related to students' socio-economic backgrounds and their consequential learning outcomes. The findings confirmed the strong association between socioeconomic background, especially parental involvement, and students' learning outcomes.

A study by Leigh and Thompson (2008) explored how early acquisition of literacy and numeracy skills is crucial for subsequent educational achievements. Their study indicated that students who master these skills early are better prepared to handle more complex subjects and show significantly better performance throughout their schooling. The study stressed that any weaknesses in these areas can severely hinder a student's ability to grasp further academic content, thereby affecting their long-term educational pursuits.

To understand the role of assessments in assessing student performance, Meeks et al. (2014) tried to explore the educational structures of countries that

achieve high rankings in "Progress in International Reading Literacy Study" (PIRLS), the "Trends in International Mathematics and Science Study" (TIMSS), and the "Programme for International Student Assessment" (PISA). The findings of the study confirmed the existence of the relationship between teachers' classroom behavior on student outcomes. The study also emphasized the importance of school governance in terms of in terms of establishing teacher training institutes and introducing initiatives to improve educational standards. Ng et al. in 2018 further extended this discussion by evaluating the impact of school accessibility, opportunity in learning contexts, strategies that boost cognitive, emotional, and behavioral engagement among students on student achievement. The study offered theoretical insights on the role of substandard instruction materials and assessments and argued that they result in incomplete learning and also tend to underestimate students' potential and quality-adjusted learning.

Lanmatchion et al. (2023) analyzed the perceptions of various key stakeholders including principals, teachers, students, and parents, and investigated the impact of school governance systems on academic performance. By utilizing qualitative methods, the study gathered data by conducting semi-structured interviews with twelve significant figures in the education sector of Benin. The findings revealed that the awareness and implementation of certain measures by stakeholders, the involvement of parents, and teaching quality significantly enhance students' academic performance. The results suggested that educational administrators could benefit from initiating training programs for all stakeholders to improve their mutual understanding of education as a goal and skills in effective school governance.

In his study, Zreik (2023) examined the determinants of educational inequality in Indonesia in terms of exploring their association with economic health and environmental issues. The data was collected through an extensive review of the literature. The findings revealed that economic imbalances contribute positively to increased underdevelopment, environmental unsustainability, and poverty levels. Moreover, inequality was further explored in the context of ethnicity, rural-urban divide, and gender differences. The study emphasized the importance of implementation of strategies for teacher training, curriculum revision, and those that upgrade infrastructure.

Moreover, Abella et al. (2024) explored the impact of literacy and numeracy standards on student outcomes by reviewing the literature. The review highlighted the importance of these standards beyond basic proficiency and stressed that they are significant for the development of critical thinking needed for academic

success. The study also criticized the standardized method of assessment by highlighting that these assessments possess inherent biases and therefore, cannot reflect students' literacy and numeracy skills accurately. The findings further suggested that our education standards need revision and digital skills must also be incorporated into them to keep pace with the changing landscape of education.

This review of the literature highlights that past studies have either examined the role of demand-side educational resources or supply-side resources in isolation. To address this gap, the present study incorporates both of these resources in one model to offer deeper insights into their complex interplay.
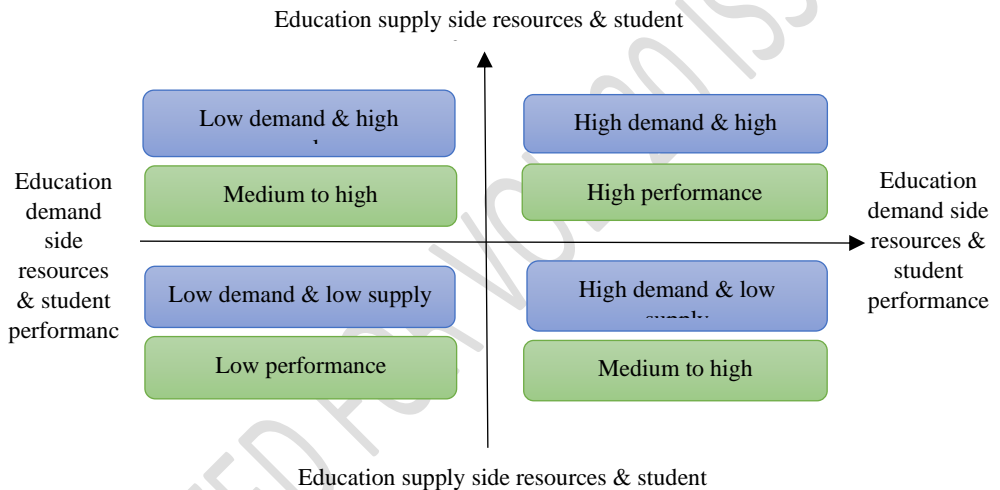
## 3.    Theoretical Framework

Various educational theories have highlighted the importance of educational resources and their difference in a larger framework of economy and how they stimulate the improved performance of the labor force and economy as a whole. Becker (1964) and Schults (1961) are the pioneers who proposed the human capital theory that highlighted the significance of improving the quality of education by investing in different educational resources. The theory argues that educational investments and the quality of human capital are directly proportional. Adam's equity theory (1963) extended this discussion by proposing equity theory that focused on the fair distribution of educational resources and opportunities. These theories argue that equitable investment in educational resources among different demographic groups improves their earning potential and the quality of human capital. These theories are relevant in Pakistan's case of learning crisis not only in terms of diagnosing issues with the education system but also in suggesting possible remedies.

The education reproduction theory (1977) proposed by Bourdieu further highlighted the role of education systems in perpetuating social inequalities. The theory stressed that our education system is designed in a way that inherently perpetuates inequality among different socio-economic groups. This means that the resources are divided unequally among economically well-off and marginalized demographic groups thereby, triggering a vicious cycle of learning poverty, class divide, and poverty, in general.  The theory argues that addressing these inequalities is crucial for achieving improved student learning outcomes and minimizing the learning- and class- divide among communities. Similarly, Pfeffer and Salancik (1978) proposed a resource dependency theory that emphasized the role of resource availability and allocation in determining student achievement.

Moreover, Bandura's social cognitive theory (1991) highlighted the role of

student engagement in learning. The theory argued that student achievement depends not only on resource availability but also on students' effort, behavior, and cognitive engagement with their educational material. This is also relevant in the case of a typical Pakistani household which divides domestic responsibilities into gender-based roles. These roles hinder their educational engagement, thereby impacting their classroom performance and achievement goals. By synthesizing the key insights from these theories, the present study constructs a four-quadrant figure to categorize student performance based on students' access to educational resources. Figure 1 illustrates how varying levels of demand-side and supply-side resources impact student performance.

**Figure 1: Inequity in education demand and supply side resources and resulting student performance**



Education supply side resources & student

| | |
|---|---|
| Low demand & high | High demand & high |
| Medium to high | High performance |
| Low demand & low supply | High demand & low supply |
| Low performance | Medium to high |

Education demand side resources & student performanc

Education demand side resources & student performance

Education supply side resources & student

Note: This figure is developed by the authors based on ideas extracted from the study of Coleman (1988) and Chetty et al. (2011).

The top right quadrant of Figure 1 depicts the optimal scenario where both demand-side and supply-side resources are high, meaning students benefit from strong socio-economic backgrounds and excellent educational facilities, resulting in high performance. The top left quadrant represents a scenario where, despite low demand-side resources, abundant supply-side resources enable students to achieve medium to high performance. Many studies from the literature stressed the role of school infrastructure and teaching quality as key indicators of student performance. The bottom left quadrant represents a situation where low demand and low supply-side educational resources result in low student performance. This is primarily the case in Pakistan with a great majority of the population living below the poverty line and schools also being not so efficient in terms of providing adequate supply-

side educational resources. Lastly, the bottom right quadrant shows that high demand and low supply side resources often result in medium to high student performance because in that case students may enjoy the liberty of affording tuition after school hours and may have access to educational resources at home.

## 4.    Methodology

Following the methodology proposed by Leigh and Thompson (2008) and Johnson and Parker (2009), the present study also considers literacy and numeracy skills as key indicators of student performance. For empirical estimation, the study employs regression analysis to model the changes in coefficients and compare them temporally. Regression analysis is chosen as an estimation technique for two main reasons. First, the dependent variable is continuous and represents the averages of students' scores in mathematics, reading, and writing and also the overall performance, calculated by averaging students' scores in mathematics, reading, and writing. Second, the model's residuals follow a normal distribution, justifying the use of a linear model for accurate and reliable analysis. Equation 1 represents the econometric equation for the analysis, providing a structured approach to analyze educational effects.

$$SP_i^O = \beta_0 + \beta_1(SINF_i) + \beta_2(TC_i) + \beta_3(EAS_i) + \beta_4(SGOV_i) + \beta_5(RES_i) + \beta_6(SEE_i) + \beta_7(SCH_i) + \beta_8(CCUR_i) + +e_i \qquad (1)$$

Where, overall student performance $(SP_i^O)$ is a function of several explanatory variables such as school infrastructure $(SINF_i)$, teacher's conduct in a classroom $(TC_i)$, easy access to school $(EAS_i)$, school governance $(SGOV_i)$, availability of resources at home $(RES_i)$, socio-economic environment around a student $(SEE_i)$, student conduct at home $(SCH_i)$ and participation in co-curricular and extracurricular activities $(CCUR_i)$. Moreover, besides overall student performance $(SP_i^O)$, equation 1 is further evaluated independently for: 1) student performance in writing $(SP_i^W)$; 2) student performance in reading $(SP_i^R)$ and; 3) student performance in Mathematics $(SP_i^M)$.

Additionally, the goodness of fit for the regression model has been tested and confirmed by the F-test for all models, indicating their overall reliability. The R-squared values, in the context of cross-sectional data, also suggested that these models explain a significant proportion of the variance in student performance. Furthermore, the residuals of all these models followed a normal distribution, highlighting the robustness and explanatory power of the models used to analyze the impact of various factors on student performance.

**Table 1: Categorization of educational resources into education demand-side and supply-side resources**

| Indices | Educational Resources | Reasoning |
|---|---|---|
| School infrastructure ($SINF_i$) | Education supply side resource | This index includes basic facilities provided by educational institutions or governing bodies. This makes it a supply-side resource. |
| Teacher's conduct in the classroom ($TC_i$) | Education supply side resource | This index includes the effectiveness of teachers' classroom practices and teaching methods. These factors are controlled and influenced by the schools' instructional and governance policies. This categorizes this index as a supply-side resource. |
| School governance ($SGOV_i$) | Education supply side resource | This index includes the monitoring of policy implementation such as the provision of free books and examining school performance by the overall administration of the school or district education officer. This makes it a supply-side resource. |
| Availability of resources at home ($RES_i$) | Education demand-side resource | This index captures the educational tools and materials available to students at the household level. These include resources that aid in student performance and since their availability depends on the socio-economic background and priorities of the parents, this index is categorized as demand-side resource. |
| Socioeconomic environment around a student ($SEE_i$) | Education demand-side resource | This index represents variables that provide information about students' homes and social environment in the form of parental support and education affordability concerns. Thus, this index can be categorized as a demand-side resource. |
| Student conduct at home ($SCH_i$) | Education demand-side resource | This index demonstrates effort on students' part despite the home environments. This fits this index into the demand-side category. |
| Participation in co-curricular and extra-curricular activities ($CCUR_i$) | Education demand-side resource | While these activities are often organized by schools, the decision to participate and the extent of engagement often depend on the students and the choice of their families. This makes this index a demand-side resource. |

Each independent variable in Equation 1 is an index constructed by averaging various variables that truly represent them. Averaging is a straightforward method to construct an index that makes the coefficients easy to interpret. Moreover, it is important to note that, the continuous variables that are part of any of these indexes have been normalized on a scale of 0 to 1. This has been done to avoid unnecessary variance in data. Since the indexes range between 0 to 1, the value of an index closer to 1 represents the maximum or absolute availability of educational resources whereas, a value closer to 0 means the minimum or absolute absence of educational resources. Table 1 further categorizes each of the indexes used on the independent side of Equation 1 into demand-side and supply-side educational resources based on rationale extracted from the literature.

## 5. Data

In the context of evaluating student performance, large-scale assessments are increasingly seen as a practical method to assess educational outcomes and to devise targeted policies and interventions. Therefore, the present study has utilized

cross-sectional microdata gathered by the *National Education Assessment System (NEAS)*, Pakistan, a public sector entity dedicated to assessing student performance in literacy and numeracy across the country. NEAS has been conducting the National Assessment Test (NAT) periodically since 2003 and also surveys key stakeholders within the education system such as parents, students, teachers, and school heads to explore the dynamics of their relationship with each other.

**Table 2: Explaining construction of variables and indexes used in the study**

| Variable | Notation | Explanation |
|---|---|---|
| Writing | $(SP_i^W)$ | A continuous variable composed of average NAT scores students attained in Urdu writing. |
| Reading | $(SP_i^R)$ | A continuous variable composed of average NAT scores students attained in Urdu reading. |
| Mathematics | $(SP_i^M)$ | A continuous variable composed of average NAT scores students attained in Mathematics. |
| Overall student performance | $(SP_i^O)$ | Overall average scores attained in Urdu writing, Urdu reading, and Mathematics. |
| School Infrastructure | $(SINF_i)$ | An index is constructed by averaging several variables that represent school infrastructure. These include student-classroom ratio, student-toilet ratio, classroom-whiteboard ratio, student-furniture ratio, availability of a science laboratory, availability of electricity, availability of water supply, availability of a library, availability of fans, availability of the heating system, and availability of medical facilities. The ratio variables have been normalized before averaging. |
| Teacher's conduct | $(TC_i)$ | An index is constructed by averaging several variables that represent a teacher's conduct. These include: if a teacher completes the course, gives homework, checks homework, gives feedback, uses a whiteboard while delivering a lecture, evaluates student performance through verbal and written tests, performs administrative duties, makes lesson plans, conducts parent-teacher meetings, uses an education kit for math, uses a teaching guide for Urdu, sends student progress reports to the homes, and if a teacher resorts to corporal punishment. |
| School governance | $(SGOV_i)$ | An index constructed by averaging a number of variables that represent school governance. These include the provision of free textbooks, regular inspection of school records by the District Education Officer (DEO), and the evaluation of teaching processes within the classroom by the DEO. |
| Availability of resources at home | $(RES_i)$ | An index is constructed by averaging a number of variables that represent the availability of resources at home. These include the availability of a calculator, computer, internet, dictionary, TV/radio, mobile phone, and books. |
| Socio-economic environment around a student | $(SEE_i)$ | An index is constructed by averaging a number of variables that represent the socioeconomic environment around a student. These include parents' literacy, parents' employment status, parents' ability to fulfill the school-related needs of their child if parents can afford paid tuition facility after school hours, and if parents/guardians provide academic help at home (in case the child does not take paid tuition). |
| Student conduct at home | $(SCH_i)$ | An index constructed by averaging a number of variables that represent student conduct at home in the form of his/her efforts to study at home. These variables include: if a student performs household chores if a student has to run market errands, if a student completes his/her homework, and if a student allocates more than an hour to study at home. |
| Participation in co- and extra-curricular activities | $(CCUR_i)$ | An index constructed by averaging a number of variables that represent student's participation in co- and extracurricular activities. These include students' participation in recitation, hamd, naat, drama, speech contests, games, physical exercises, and scouting or girl guide programs. |

Note: 1) All the variables that have been indexed have binary responses with 1 representing Yes and 0 otherwise.
2) The variables with negative connotations have been transformed by subtracting them from 1 before taking averages, to convert them into positive statements.

The study uses the NEAS data for the years 2008 and 2016 and compares their results. The 2008 dataset 11,943 is comprised of students, while the 2016 dataset includes 13,004 students. It is important to note that the data for both years consisted of grade 4 students. The table below discusses the construction of variables used in this study:

Constructing dependent and independent variables using the framework mentioned in Table 2 provides a structured and robust approach to understanding and addressing the key determinants of student academic performance.

## 6. Results

The results of regression analyses are presented in Tables 3, 4, 5, and 6. Table 3 gives results with overall student performance taken as the dependent variable, Table 4 presents results with writing performance taken as a dependent variable, Table 5 considers reading performance as the dependent variable, and Table 6 considers mathematics performance as the dependent variable. These tables demonstrate how each dependent variable interacts with various indexes on the independent side of equation 1. Moreover, the regression coefficients have been standardized to make them comparable temporally.

Table 3 reveals that the influence of school infrastructure on student performance is growing over time. Teachers' conduct in a classroom was already a strong indicator of student performance in 2008 and by 2016, its relationship became even stronger. The association between school governance and student performance on the other hand slightly declined over time. This suggests that its contribution has become less critical in determining student performance when compared with other determinants.

**Table 3: Regression analysis of overall student performance**

| Overall student Performance | 2008 Coefficient | 2008 Standard error | 2016 Coefficient | 2016 Standard error |
|---|---|---|---|---|
| School infrastructure | (0.010) | .035 | (0.156)*** | .012 |
| Teachers' classroom conduct | (0.203)*** | .015 | (0.313)*** | .012 |
| School governance | (0.049)*** | .016 | (0.012)* | .007 |
| Resource availability at home | (0.012)*** | .004 | (0.022)*** | .006 |
| Socio-economic environment | (0.012) | .008 | (0.005) | .009 |
| Student conduct at home | (0.043)*** | .006 | (0.059)*** | .008 |
| Co and extracurricular activities | (0.038)*** | .005 | (0.102)*** | .007 |
| Mean | 0.729 | | 0.444 | |
| SD | 0.155 | | 0.206 | |
| R-squared | 0.410 | | 0.471 | |
| N | 10840 | | 12808 | |
| F-test | 58.449 | | 232.300 | |
| Prob > F | 0.000 | | 0.000 | |
| AIC | -10067.042 | | -5784.724 | |

*** $p<.01$, ** $p<.05$, * $p<.1$ Note: The coefficients have been standardized to make them comparable temporally.
Source: Authors' calculations based on NEAS data from 2008 and 2016

Resource availability at home gave evidence of a positive association with student performance with its magnitude slightly increasing from 2008 to 2016 whereas, the magnitude of the socio-economic environment around a student slightly decreased despite being positive. Student conduct at home and students' participation in extra- and co-curricular activities demonstrated a significant positive increase in their association with student performance. This highlights the role of student engagement with academic material at home and participation in co- and extracurricular activities has become integral in fostering student performance over time.

Table 4 considers writing performance as a dependent variable. Results highlight that the influence of school infrastructure on writing performance was insignificant in 2008 but by 2016 this influence turned significantly positive with a drastic increase in magnitude. Teachers' conduct in the classroom already showed a strong positive association with writing performance in 2008 whereas, by 2016, this association became even stronger. The relationship between school governance and writing performance on the other hand became weaker over time. This suggests that the condition and quality of school governance have become less important in determining student performance when compared with other determinants of writing performance.

**Table 4: Regression analysis of performance in writing**

| Writing performance | 2008 Coefficient | 2008 Standard error | 2016 Coefficient | 2016 Standard error |
|---|---|---|---|---|
| School infrastructure | (-0.085) | .074 | (0.301)*** | .023 |
| Teachers' classroom conduct | (0.503)*** | .032 | (0.413)*** | .022 |
| School governance | (0.084)** | .034 | (-0.011) | .012 |
| Resource availability at home | (0.058)*** | .008 | (0.062)*** | .010 |
| Socio-economic environment | (0.014) | .017 | (-0.051)*** | .016 |
| Student conduct at home | (0.054)*** | .013 | (0.112)*** | .014 |
| Co and extracurricular activities | (0.070)*** | .011 | (0.107)*** | .013 |
| Mean | 0.361 | | 0.487 | |
| SD | 0.331 | | 0.374 | |
| R-squared | 0.440 | | 0.482 | |
| N | 10840 | | 12808 | |
| F-test | 61.810 | | 143.659 | |
| Prob > F | 0.000 | | 0.000 | |
| AIC | 6318.582 | | 10043.842 | |

*** $p<.01$, ** $p<.05$, * $p<.1$  *N*ote: The coefficients have been standardized to make them comparable temporally
*Source: Authors' calculations based on NEAS data from 2008 and 2016*

Resource availability at home gave evidence of a significant positive association with writing performance with its magnitude slightly increasing from 2008 to 2016 whereas, the coefficient of socio-economic environment turned negative in 2016. This may suggest that parental involvement in students' academic

achievement reduces with an increase in their socio-economic conditions. Student conduct at home and students' participation in extra- and co-curricular activities demonstrate a significant positive increase in their relationship with writing performance. This highlights the role of student engagement with these activities has become integral in fostering student performance in writing over time.

Table 5 presents results with reading performance taken as a dependent variable. It reveals that the association between reading performance and school infrastructure has improved in terms of magnitude and significance over time. Teachers' conduct in the classroom also showed a drastic improvement in its magnitude and significance, confirming its role as an important determinant of student performance in reading.

The association between school governance and student performance in reading was negative in 2008 but this association turned significant and positive by 2016. Resource availability at home showed positive results in 2008 as well as 2016. Student conduct at home and students' participation in extra- and co-curricular activities demonstrated a significant positive relationship with student performance in reading in both years. This confirms their role as an important determinant.

**Table 5: Regression analysis of performance in reading**

| Reading performance | 2008 Coefficient | 2008 Standard error | 2016 Coefficient | 2016 Standard error |
|---|---|---|---|---|
| School infrastructure | (.059)* | .032 | (.074)*** | .013 |
| Teachers' classroom conduct | (.032)** | .014 | (.264)*** | .013 |
| School governance | (-.005)** | .003 | (.007)*** | .006 |
| Resource availability at home | (.033) | .015 | (.038) | .007 |
| Socio-economic environment | (-.003) | .007 | (.026)*** | .010 |
| Student conduct at home | (.038)*** | .006 | (.027)*** | .008 |
| Co and extracurricular activities | (.013)*** | .004 | (.120)*** | .008 |
| Mean | 0.954 | | 0.464 | |
| SD | 0.138 | | 0.220 | |
| R-squared | 0.391 | | 0.483 | |
| N | 10840 | | 12808 | |
| F-test | 12.310 | | 145.302 | |
| Prob > F | 0.000 | | 0.000 | |
| AIC | -12180.800 | | -3539.908 | |

*\*\*\* p<.01, \*\* p<.05, \* p<.1*  Note: The coefficients have been standardized to make them comparable temporally
*Source: Authors' calculations based on NEAS data from 2008 and 2016*

Table 6 considers student performance in mathematics as a dependent variable. Results reveal that the influence of school infrastructure and teachers' classroom conduct on mathematics performance has drastically improved in its significance and magnitude over time. The association between school governance and mathematics performance on the other hand declined over time. This suggests that the condition and quality of governance have become less important in

determining mathematics performance. Resource availability and mathematic performance show an insignificant relationship in 2016 whereas, the impact of the socio-economic environment grew in terms of its magnitude and significance.

**Table 6: Regression analysis of performance in mathematics**

| MATHEMATICS | 2008 Coefficient | 2008 Standard error | 2016 Coefficient | 2016 Standard error |
|---|---|---|---|---|
| School infrastructure | (.056) | .049 | (.093)*** | .011 |
| Teachers' classroom conduct | (.073)*** | .021 | (.262)*** | .011 |
| School governance | (.03) | .023 | (.009) | .006 |
| Resource availability at home | (-.016)*** | .005 | (-.002) | .005 |
| Socio-economic environment | (.024)** | .011 | (.041)*** | .008 |
| Student conduct at home | (.038)*** | .009 | (.038)*** | .007 |
| Co and extracurricular activities | (.032)*** | .007 | (.08)*** | .006 |
| Mean | 0.873 | | 0.380 | |
| SD | 0.215 | | 0.185 | |
| R-squared | 0.391 | | 0.453 | |
| N | 10840 | | 12808 | |
| F-test | 12.782 | | 163.854 | |
| Prob > F | 0.000 | | 0.000 | |
| AIC | -2650.442 | | -8165.847 | |

*** $p<.01$, ** $p<.05$, * $p<.1$  Note: The coefficients have been standardized to make them comparable temporally
*Source: Authors' calculations based on NEAS data from 2008 and 2016*

Similarly, student conduct at home and students' participation in extra- and co-curricular activities demonstrated a significant positive increase in their association with student performance. This highlights that the role of student engagement with academic activities and co- and extracurricular activities has become integral in fostering student performance over time.

## 6.1. Results Discussion

The results of the regression analyses reveal insightful trends in the case of different outcome variables such as overall student performance, writing performance, reading performance, and performance in mathematics. Some of the independent side variables showed modest change while others gave evidence of varying impacts over time.

The findings revealed that among the supply-side resources, the association between school infrastructure, overall, has consistently improved in its magnitude and significance level for all of the dependent variables. The growing importance of school infrastructure is likely due to investments in upgrading school facilities and environment under Pakistan Education Sector Plan (PESP) 1 and 2. Under PESP 1 and 2, the condition of supply-side educational resources has been improved in different marginalized parts of Pakistan. With the improvement in school amenities, the school environment becomes relatively more conducive to student learning. Teachers' classroom conduct turned out to be the most influential independent variable that was already strong in its magnitude and significance in

2008 but in 2016 that influence became even stronger. This increased significance can be attributed to different initiatives that the government has launched to train teachers. These programs and institutes include the *Pakistan Institute of Teacher Training* (PITE) in KP, the *Quaid-e-Azam Academy for Educational Development* (QAED) in Punjab, the *National Institute of Excellence in Teacher Education* (NIETE) that operates on a national level and several interventions launched by *Federal Directorate of Pakistan* (FDE) in collaboration with various local and international NGOs such as *Malala Fund*, *The citizens Foundation* (TCF) and Idara Taleem-o-Aaghai, etc are also operating on a national level to improve the condition of supply-side educational resources.

School governance, however, experienced a decline in its importance in determining student performance despite being a significant positive indicator. However, overall, their association with overall student performance remained significantly positive. It may also suggest the importance of standardized governance practices across the country to improve its significance. Moreover, invigilation by district education officer (DEO) as a key component of school governance sometimes triggers fear among students and teachers. This fear of being examined and judged may impact their performance negatively. Also, during invigilation, sometimes discipline is maintained artificially through strict discipline orders from school administration, which may also influence the classroom performance academically. Demand-side resources, on the other hand, such as student conduct at home, and co- and extracurricular activities have also become increasingly influential, particularly in reading and writing. Moreover, resource availability at home saw a modest increase in some cases while a decline in others. This reflects the complex dynamics of access to demand-side educational resources at home.

In a nutshell, while both supply-side and demand-side educational resources are important, the results of this study suggest that the impact of supply-side resources, in terms of their magnitude and significance is more pronounced. This indicates that as education systems evolve, there is a growing need to balance investments in both supply-side and demand-side resources.

## 7.    Conclusion

The study aimed at quantifying the critical role of various educational resources in shaping student performance in Pakistan. It explored the issue of differences in educational resources available to students as a major determinant contributing to the country's prevalent learning crisis. For empirical estimation, the study used nationally representative cross-sectional microdata collected by the

National Education Assessment System (NEAS) for the years 2008 and 2016 and compared the results for both years using regression analyses.

The findings shed light on the complexity of the interplay between supply-side and demand-side educational resources in determining student performance. Results confirmed that certain supply-side resources such as school infrastructure and teacher's classroom conduct have generally increased in their significance and magnitude, thereby confirming their continued importance. These findings align with the studies by Aikens and Barbarin (2008) and Chetty et al. (2011) which provided evidence that well-equipped and conducive learning environments in schools improve student performance, and that high-quality teaching is one of the most important contributors to student performance, respectively.

On the other hand, among demand-side variables, students conduct at home in the form of time students spend completing homework despite the domestic responsibilities reflecting academically conducive home environment. This finding is corroborated by Hill and Tyson (2009). Moreover, student participation in co- and extracurricular activities also emerged as an important indicator of student performance. This finding is consistent with the study by Fredricks and Eccles (2006) who argued that engagement in co-curricular activities improves student performance by positively influencing their mental and physical health.

Thus, the results conclude that improvements in school infrastructure and teaching quality remain vital in determining student performance. This implies that, since the returns to improved school infrastructure and teaching quality are higher than other indicators, educational policies and interventions must target them further to enhance student performance effectively. However, for sustained improvements in student outcomes, balancing investments between supply-side resources as well as support for demand-side factors may likely help in alleviating the learning crisis in the long run.

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