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An Empirical Assessment of District-Level Disparities in Educational Performance in Khyber Pakhtunkhwa

Shahzeb¹, Muhammad Azam Khan², Muhammad Tariq³ & Farah Khan⁴

¹Department of Economics, Abdul Wali Khan University Mardan, KP, Pakistan. Email: shahzebkhan248@gmail.com

²Department of Economics, Abdul Wali Khan University Mardan, KP, Pakistan,

Email: drazam75@yahoo.com; drazam75@awkum.edu.pk; <https://orcid.org/0000-0001-7417-3981>

³Department of Economics, Abdul Wali Khan University Mardan, KP, Pakistan, Email: tariq_noor@awkum.edu.pk

⁴Institute of Education & Research (IER), Women University Mardan, KP, Pakistan,

Email: drfarah@wumardan.edu.pk

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Corresponding Author:

Shahzeb

Email:

shahzebkhan248@gmail.com

ABSTRACT

This paper aims to compare the performance of education within the district level in Khyber Pakhtunkhwa (KP), Pakistan and also to identify whether focusing on learning outcomes does affect the performance ranking and policy interpretation. Comparative analysis of the Provincial Education Performance Index of KP is done with the use of the framework of District Education Performance Index 2023 and applied to all the districts of KP in the year 2023. Based on the data provided by the National Education Management Information System, the research employs a composite index methodology alongside normalization and weighted aggregation methods. Besides the traditional domain structure of learning, infrastructures and access, and governance and management, the study goes on to test the sensitivity of ranking through a weighted scheme of learning prioritized by increasing the weight of learning to 40%. The findings indicate that there are high levels of intra-provincial inequalities with no district coming out as an overall high performer. The domain of learning is found to be the weakest in most of the districts and the districts with a relatively strong infrastructure and governance do not always achieve better learning outcomes, hence showing the lack of correspondence between the inputs and the outcomes. The research concludes that the improvement of the level of educational achievements in KP requires a strategic transition to the learning-centered planning, with the help of district-specific interventions and evidence-based policy development, employing the performance indices as a decision-making instrument.



Introduction

Khyber Pakhtunkhwa (KP) province is a region with various socio-economic issues, which still hinder its developmental achievements and performance. These issues include among others, the continued educational inequality especially in the rural and the impoverished districts whose education levels are significantly lower compared to the urban ones. These inequalities are closely related to more systemic constraints, such as high poverty, inadequate social infrastructure in rural areas, and gender-based marginalization, which play a significant negative role in the formation of human capital and long-term economic sustainability (Tauheed & Nasir, 2020). Leoni (2025) argues that the existence of strong socio-economic disparities is likely to undermine the quality of governance, reduce output, and reduce chances of social upward mobility. Becker (1962) emphasizes that persistent investment in education, health, and skill training is necessary to close the gaps between the economies on different sides of the geographic line; without ongoing investment, poor regions to remain in a state of low-growth and low-payoff equilibrium. In KP, restricted fiscal abilities restrain government expenditures on education and health, exacerbating inequality between urban and rural districts contributing to social stratification, as well as under-exploitation of the demographic potential of the province.

In their study, Hasan et al. (2021) examined the districts of KP namely Peshawar, Nowshera, Mardan, Haripur, and Abbottabad which are the most productive districts based on satellite generated night-light intensity estimates of their economic output. However, a different trend emerges when the districts are ranked based on indicators of educational performance. The implication of this difference between economic and educational performance is that increased economic activity does not always correspond to improved learning outcomes. This observation underscores the need to come up with industry-specific performance measurement instruments as opposed to using macroeconomic indicators as development proxies. Recent efforts in Pakistan also underscore the growing importance of assessing learning outcomes. The Government of KP conducted a large-scale end-line survey in 2025 to evaluate student performance in the core subjects as part of overall initiative to enhance the quality of education (Niaz & Rose, 2025). Many prior studies have explored the significant role of education in promoting social welfare of society (Abu et al 2014; Ali et al., 2025; Azam & Ahmed, 2015; Khan, 2025; Khan et al., 2025ab; Rivaldo, & Khan, 2025; Ngoobi et al., 2026). Similarly, changes in educational assessment and capacity-building, like the Aga Khan University program, the Assessment for Learning, in 2026, indicate a broader shift in the discourse of the educational sector of Pakistan to the learning-based evaluation models (Aga Khan University, 2026). Despite these positive developments, the majority of current research and policy instruments focus on the national-level comparisons and generic measures. There is therefore a limited of academic research on the ways in which educational performance may be systematically quantified at sub-national levels especially when other policy considerations like learning outcomes are included in the performance measurement systems.

Despite the long-term public investment, the results of education in KP are still unequal; the learning of students has been worse than the improvement of access, infrastructure, and governance. According to the DEPIx 2023, KP is relatively performing well on the administrative and access indicators, but the learning outcomes are weak, which signals that there is no relationship between inputs and outputs (Planning Commission of Pakistan, 2024). Major discrepancies are found between districts: others have good infrastructure and management but they record poor learning achievement, and still some face long-term restrictions to access and inclusion. National indices like DEPIx apply uniform weighting across domains, potentially underrepresenting KP's most critical challenge improving learning. This study addresses this problem by applying the DEPIx framework at the provincial level to analyze district-wise

education performance in KP and by exploring the implications of prioritizing learning outcomes for education assessment and policy decision-making.

The study attempts to quantify educational performance at the district level in Khyber Pakhtunkhwa by developing and implementing a composite index called PEPIx-KP. It also aims to analyze intra-provincial differences in educational achievements among various districts and within various spheres of education. Also, the study provides evidence-based policy recommendations that will assist policymakers in enhancing education performance at the district level across KP.

This study develops a provincial education performance index for KP and applied it to all districts to evaluate educational outcomes across key domains, including access, inclusion, infrastructure, governance, and learning. A comparison on inter-district differences reveals that school infrastructure, teacher availability, gender differences, digital access and funding are among the factors that determine educational performance. Current literature in KP indicates that there are challenges such as gender differences, socio-cultural obstacles and inadequate infrastructure which impacts on enrollment and retention, especially in the rural regions. These results emphasize the role of district-level, domain-specific study to facilitate policy-specific intervention and lead to better educational results in accordance with the developmental goals in general.

The rest of the article is arranged in the following way. Section Two is a review of the theoretical and empirical literature and identification of the research gap. Section Three describes the research methodology, that is, the creation of the education performance index, source of data and methods of analysis. Section Four summarizes and discusses the findings as per the objectives of the research. Lastly, Section Five is a summary of findings and concludes and offers policy recommendations.

Literature Review

Theoretical Literature

The study of Curle (1971) analyzed quality and equity in education as being tightly coupled with the degree of socio-economic development and claims that education is the driver and the indicator of societal development. This theoretical perspective in the situation of the Khyber Pakhtunkhwa (KP) puts the Provincial Education Performance Index (PEPIx-KP) not only as a diagnostic tool but as a tool that could inform provincial development planning. The most important issue, though, is to make sure the index goes beyond the descriptive statistical analysis and turns into a viable tool of informing specific educational intervention. Availability of Information and Communication Technology (ICT) has been identified to be a significant factor of educational outcomes. Wasif et al. (2012) surveyed the use of ICT and student learning performance are positively related in Pakistani learning institutions. In spite of this fact, most of the educational performance indices still consider ICT as a peripheral element as opposed to a performance indicator. The presence of workable ICT laboratories within the framework of PEPIx-KP, can thus be considered not only as an infrastructure indicator but also as a technological modernization and digital preparedness indicator, which is also in line with international standards on education technology integration.

Empirical Literature

The study of Ahmed et al. (2019) compared the data concerning the administration education with randomized visits to support and discovered that the decrease in the absenteeism of teachers had a strong impact on enhancing the performance of students in mathematics. Even though the study is

context-oriented it emphasizes the empirical role of the variables relating to governance especially the presence of teachers in determining learning outcomes. This fact implies that in the PEPIx-KP framework, teacher attendance and professional development are not to be considered as administrative predictors but rather as important determinants of the quality of learning. Tauheed and Nasir (2020) created inequality-adjusted education indices in Khyber Pakhtunkhwa and found that there are significant differences within the districts on the basis of place of residence and gender. The research has quantified the contribution of variables like urban-rural differences or gender disparities and the contribution of these variables to the total education inequality by using inequality decomposition methods like the Theil index. The results of their research lend serious empirical support to the disaggregation of domains to the KP index of education performance, indicating that PEPIx-KP ought to add the aspect of district-level and population-group-based inequality analysis to improve the representation of educational achievement distribution. Verma et al. (2020) studied the methodological validity of composite index construction using the comparison of principal component analysis (PCA)-derived weights and equal weighting methods on education and development indices. According to their discovery, PCA can give a weight that is disproportionately high to the indicators with high correlation levels which may be subject to biased interpretation. This empirical fact indicates that although PCA may be invested in robustness verification in the PEPIx-KP model, the primary outcomes would be better based on equal or expert-informed weights to help uphold clarity and policy significance.

Xiang et al. (2020) developed the Index of Regional Education Advantage (IREA), to assess the inequality in education provision, access and achievement at the regional level in China through the integration of indicators associated with educational provision, access and achievement. The research used to test spatial regression models to validate the index, and the results were that the index highly correlates with the economic indicators of a region. Although IREA offers an excellent methodological framework, its focus on infrastructure and enrollment can ignore other significant aspects such as displacement and digital access. However, its spatial analytical method can provide valuable methodological information that can be translated to the PEPIx-KP framework. Bhatt et al. (2022) studied the educational inequality of districts in India through the application of spatial statistics, including Moran I and Local Indicators of Spatial Association (LISA). Their analysis showed there was much spatial clustering of learning outcomes and education infrastructure with the presence of so-called hotspots of poor performance, which are in many cases in remote or socio-economically disadvantaged areas. These results indicate the usefulness of the spatial analysis in measurement of geographically clustered education issues. Regarding KP, in which geographic accessibility and condition of development is heterogeneous across districts, these spatial methods may have a significant value within influencing specific resource distribution and policy responses.

Literature on Pakistan and Khyber Pakhtunkhwa

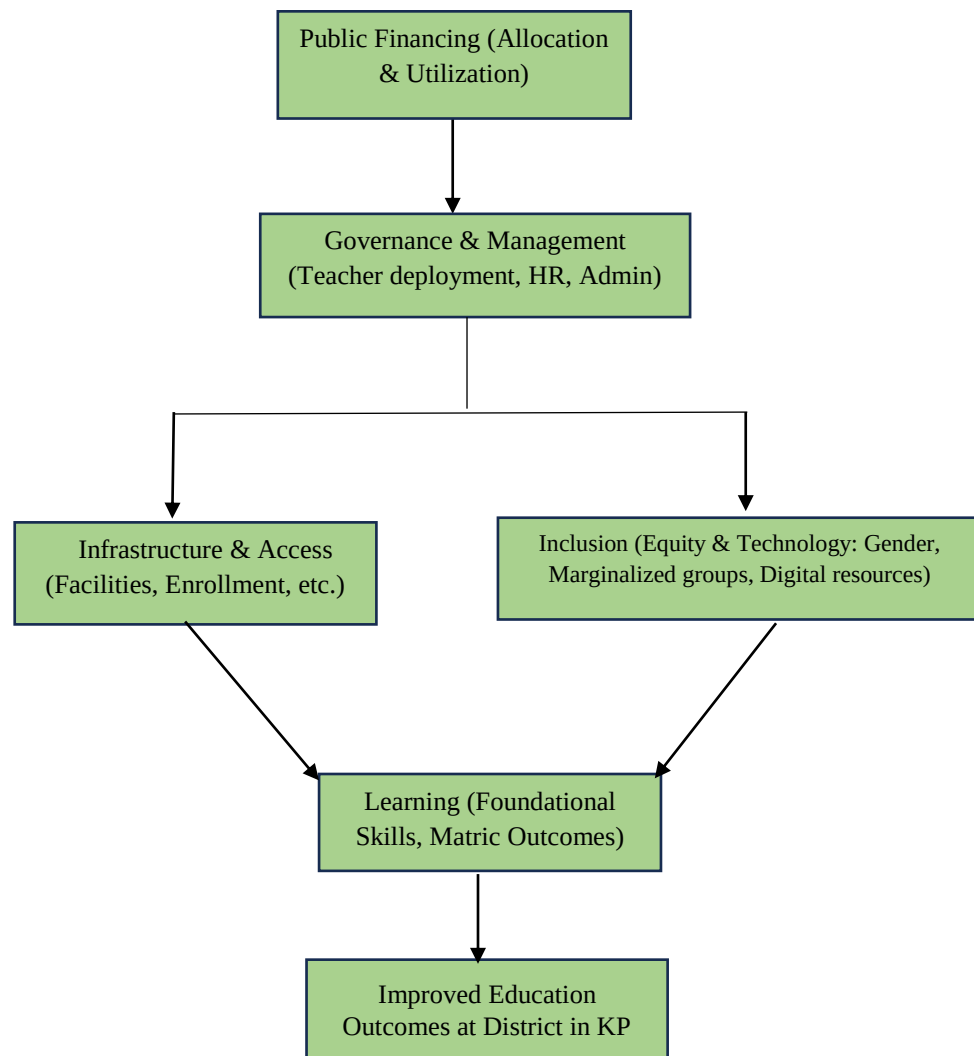
Yang et al. (2020) evaluated technology-based independent monitoring using administrative data and quasi explanatory design. Their results prove the causality between the input of governance and learning outcomes and suggest that the improvement of teacher attendance and accountability through smartphones-based monitoring and real-time dashboards can produce measurable improvement in student performance. Despite other weaknesses of the study like heterogeneity of programs and possible Hawthorne effects, the research provides plausible empirical data of Khyber Pakhtunkhwa (KP) that validates inclusion of teacher attendance and monitoring coverage as important governance indicators. Annual Status of Education Report (ASER, 2023/24) reports consistently show the low rates of foundational literacy and numeracy in the whole of Pakistan, also in KP, but also gender and rural-urban inequalities. The household-based surveys of ASER

allow snapshots of data at a district level and time dynamics which can be an external validation of the learning domain of PEPIx-KP index. Despite the representative sampling, the cross-sectional nature of ASER and the study of basic competencies instead of curriculum-based tests are certain drawbacks. However, it is possible to utilize ASER data to triangulate the district learning scores and investigate the convergence of learning indicators and composite index rankings.

The District Education Performance Index (DEPIx), provided by (Planning Commission of Pakistan, 2024) includes 134 districts in the country. The average score in the country was 53.46, at Punjab stood 61.39, KP 54.47, Sindh 51.55 and Balochistan 45.50. There were also significant disparities within the provinces in KP: the relatively well performing districts like Haripur were sharply opposed by the low performing ones like Upper Kohistan and Kolai-Palas. Even though DEPIx presents a complete framework, it does not account for KP-specific determinants like refugee enrolment, geographic remoteness, or the availability of ICT infrastructure. Moreover, no district achieved a “Very High” performance category, highlighting the need for more context-sensitive provincial analysis. These gaps provide the foundation for the development of the PEPIx-KP framework. Shoukat et al., (2025) demonstrate that inclusive education policies can significantly improve academic outcomes for students with disabilities when supported by adequate resources, teacher training, and flexible curricula. Given that KP hosts a considerable population of internally displaced and refugee children, this finding supports the inclusion of indicators capturing refugee enrollment and equitable access for marginalized groups. (Ilyas et al., 2025) provide macroeconomic evidence showing that improvements in education outcomes contribute to higher GDP per capita and poverty reduction. These findings reinforce the role of improved access to quality education, digital literacy, and gender equality as key drivers of long-term socio-economic development.

This study observed yawning gap in the existing literature, where (a) DEPIx 2023 provides national-level district comparisons, with limited focus on intra-provincial dynamics; (b) National rankings do not sufficiently explain why districts within the same province perform differently, (c) learning is treated as one of several equally weighted domains, despite being the ultimate objective of education policy, and (d) DEPIx does not test how alternative domain weightings affect district rankings. Therefore, in this study tried to reduce the existence gap while (a) conducts a focused district-level comparative analysis within Khyber Pakhtunkhwa, enabling deeper understanding of intra-provincial disparities, (b) provides contextual interpretation of district-level variations in KP across infrastructure, learning, inclusion, governance, and financing, (c) introduces a learning-prioritized analytical perspective to highlight outcome-oriented performance differences, and (d) demonstrates the sensitivity of education performance rankings to normative weighting choices, strengthening policy interpretation. Figure 1 is the conceptual framework of the study and which is self-explanatory.

Figure 1: Conceptual Framework



Source: Authors' own work

Data and Methodology

This research design has been integrated into the study as a quantitative index-based comparative research design to determine a comparative analysis of the provincial education performance in Khyber Pakhtunkhwa (KP). The study is pegged on cross-sectional study in 2023 based on secondary information found in official national data. The analysis relies on the District Education Performance Index (DEPIx) model and uses it at provincial level to make a comparative analysis of the Provincial Education Performance Index of Khyber Pakhtunkhwa (PEPIx -KP). Besides the imitation of the original DEPIx structure, the paper also presents a different weighting situation where learning outcomes are given more weight and thus the original index outcomes are compared to simulated learning-based policy.

Education Index Construction

Education Development Index (EDI)

Education Development Index (EDI) is a composite indicator that is specifically meant to measure the status and progress of education. The EDI takes several connected indicators to create one score, which attempts to recognize geographical areas that lag behind in education performance, to monitor progress of universal and quality education, and to aid in making evidence-based decisions in resource distribution. At on a global scale, in 2006, UNESCO presented the Education for All Development Index (EFA-DI) which is a metric to assess the achievement of the global Education for All targets. The EFA-DI includes the measures of universal primary education, adult literacy, quality of learning, and gender parity. On the national level, in 2005-06, the National University of Educational Planning and Administration (NUEPA) prepared the EDI in consultation with the ministry of Human Resource Development (MHRD). The EDI was then modified and applied with the help of Education Management Information System (EMIS) data and developed an EDI of the North-Western Zone (Salawu et al., 2021).

Mathematical Formulas / Equations

EDI calculation comprises several statistical steps. Firstly, all indicators are brought to a common platform so as to make them comparable, since in most cases they assume different units and scales. Normalization takes the value of each indicator to a figure between 0 and 1 such that higher values always represent better performance (Salawu et al., 2021).

$$NV_{ij} = 1 - \left[\frac{\{Best\ X_i - Observed\ X_{ij}\}}{\{Best\ X_i - Worst\ X_i\}} \right] \quad (1)$$

Here, $NV_{\{ij\}}$ represents the normalized value for indicator i in region j , $X_{\{ij\}}$ is the actual observed value, and $Best_{X_i}$ and $Worst_{X_i}$ are the best and worst reference values for that indicator. The BEST and the WORST values will depend upon the nature of an indicator. In case of a positive indicator, the highest value will be treated as the best value and the lowest, will be considered as the worst value. Similarly, if the indicator is negative in nature, then the lowest value will be considered as the best value and the highest, the WORST value (Salawu et al., 2021).

After normalization, the next step is to determine the weights of each indicator. However, a more sophisticated method uses Principal Component Analysis (PCA) to statistically derive weight based on the variance each indicator explains in the dataset. In PCA, the weight for each indicator is calculated as the sum of the products of its factor loadings and the eigenvalues of the principal components (Salawu et al., 2021).

$$w_i = \sum_{k=1}^m (FactorLoading_{\{ik\}} \times Eigenvalue_k) \quad (2)$$

In this equation, m represents the number of principal components selected to explain a substantial portion of the total variance, often set at 85 percent or higher. This approach ensures that indicators with greater statistical significance in explaining differences across regions receive higher weights.

Once the weights are established, the next step is the computation of the dimension index for each of the EDI's dimensions, such as infrastructure & access, governance & management, learning, inclusion, and public financing. The dimension index is calculated as a weighted average of the normalized values of all indicators within that dimension (Salawu et al., 2021).

$$DI_d = \frac{\{\sum_{\{i \in d\}} w_i \cdot NV_{\{ij\}}\}}{\{\sum_{\{i \in d\}} w_i\}} \quad (3)$$

At this final step that construction of the composite EDI happens, such that the dimension indices collapsed into a single final score. This is by calculating a weighted average of each dimension index (Salawu et al., 2021).

$$EDI_j = \frac{\{\sum_{\{d=1}^D W_d \cdot DI_d\}}{\{\sum_{\{d=1}^D W_d\}}} \quad (4)$$

In this formula, W_d represents the weight assigned to each dimension, and D is the total number of dimensions considered. Weights for dimensions can be equal if the intention is to give all aspects of education equal importance, or they can be derived from PCA if the analysis aims to reflect the relative importance of each dimension in explaining variance across regions (Salawu et al., 2021).

Domain Weights under Learning-Prioritized Framework

The relative weight that is placed on the five domains indicates the relative importance that is placed on input and output/outcome level measures.

Table 1: Domain Weights under Learning-Prioritized Framework

Domain	Weight
Infrastructure & Access	25
Learning	40
Inclusion: Equity & Technology	15
Governance & Management	10
Public Financing	10
Total	100

Source: Author's owns work

Parameter Weights

To be scored, the domains have been assigned a 100-score that is distributed between the domain's parameters and indicators. Each of the parameters has the score that is assigned based on its criticality when evaluated with respect to the respective domains. After the cumulative score of all the parameters in each domain was established, it was indexed against the weight of each domain assigned.

Table 2: Parameter Weights

Domain	Parameter	Indicator	Indicator Weight (sum=100 per parameter)	Parameter Weight (Sum=100 per Domain)
Infrastructure & Access	Infrastructure and Allied Facilities	Number of public primary schools per 1000 children aged 5-9 years	4	
Infrastructure & Access	Infrastructure and Allied Facilities	Number of public middle schools per 1000 children aged 10-12 years	2	

Infrastructure & Access	Infrastructure and Allied Facilities	Number of public high schools per 1000 children aged 13-14 years	2	20
Infrastructure & Access	Infrastructure and Allied Facilities	Number of public higher secondary schools per 1000 children aged 15-16 years	2	
Infrastructure & Access	Infrastructure and Allied Facilities	Percentage of public primary schools that achieve completeness of school facilities	4	
Infrastructure & Access	Infrastructure and Allied Facilities	Percentage of public middle schools that achieve completeness of school facilities	2	
Infrastructure & Access	Infrastructure and Allied Facilities	Percentage of public high schools that achieve completeness of school facilities	2	
Infrastructure & Access	Infrastructure and Allied Facilities	Percentage of public higher secondary schools that achieve completeness of school facilities	2	
Infrastructure & Access	Student Participation	Percentage of OOSC in the total schools-age population	50	50
Infrastructure & Access	Student Attendance	Average annual attendance percentage of all students in public schools	5	5
Infrastructure & Access	Transition	Primary to middle transition rate in public schools	12.5	25
Infrastructure & Access	Transition	Middle to high transition rate in public schools	12.5	
Learning	Grade 3 Proficiency	Percentage of Grade 3 students who can read/comprehend sentences in English	5	20
Learning	Grade 3 Proficiency	Percentage of Grade 3 students who can read/comprehend story in Urdu/Sindhi/Pashto	5	
Learning	Grade 3 Proficiency	Percentage of Grade 3 students who can do 2-digit division	10	
Learning	Grade 4 Proficiency	Mean score of Grade 4 students in English	5	20
Learning	Grade 4 Proficiency	Mean score of Grade 4 students in Urdu	5	
Learning	Grade 4 Proficiency	Mean score of Grade 4 students in Maths	10	
Learning	Passing Rate in Matric Examinations	Percentage of students who pass matric examinations regardless of age	30	30
Learning	Adult Literacy	Percentage of population of people age 10 and above with basic literacy skills	30	30
Inclusion	Gender Parity	Ratio of girls GER against boys GER in public schools	12.5	
Inclusion	Gender Parity	Ratio of girls to boy's primary transition rate	12.5	

Inclusion	Gender Parity	Ratio of girls to boys passing Matric examination	12.5	50
Inclusion	Gender Parity	Ratio of female rural basic literacy against male rural basic literacy (10 years and above)	12.5	
Inclusion	School Inclusiveness for Differently Abled Students	Percentage of children with difficulty in basic functionality (seeing, hearing, walking, speaking, memory, and personal care) enrolled in school	25	25
Inclusion	Technology in Education	Percentage of public schools with internet connectivity	12.5	25
Inclusion	Technology in Education	Percentage of public high schools with computer labs	12.5	
Governance & Management	Administrative Continuity	Average tenure of Education Secretary in a province	40	40
Governance & Management	Teacher Availability	Percentage of filled teacher positions in public schools	30	60
Governance & Management	Teacher Availability	Percentage of single-teacher public primary schools	15	
Governance & Management	Teacher Availability	Average annual attendance percentage of all teachers in public schools	15	
Public Financing	N/A	Percentage of education budget in the total district budget	50	100
Public Financing	N/A	Education development budget spent in the district per OOSC student	25	
Public Financing	N/A	Percentage of budget spending on primary and secondary education in a province	25	

Source: Planning Commission of Pakistan (PCP, 2024)

Structure of the PEPIx

The PEPIx structure follows a three-tier hierarchy that reflects key areas aligned to the education delivery chain. The three-tier hierarchy is domains, parameters, and indicators. PEPIx consists of 5 domains, 13 parameters, and 34 indicators.

Domains: Thematic areas that cover key system-level components related to education performance and progress.

Parameters: Clusters of closely connected metrics within the thematic areas which help assess performance across a focused component in the education system.

Indicators: Metrics to assess specific and singular measures of performance within a parameter.

Domain 1 – Infrastructure & Access

The Infrastructure & Access domain has 4 parameters and 12 indicators:

Table 3: Infrastructure & Access

Domain 1	Parameter	Indicator(s)	References
Infrastructure & Access	Infrastructure and Allied Facilities	Number of public primary schools per 1000 children aged 5-9 years	(Planning Commission of Pakistan, 2024)
		Number of public middle schools per 1000 children aged 10-12 years	(PCP, 2024)
		Number of public high schools per 1000 children aged 13-14 years	(PCP, 2024)
		Number of public higher secondary schools per 1000 children aged 15-16 years	(PCP, 2024)
		Percentage of public primary schools that achieve completeness of school facilities	(PCP, 2024); (Pakistan District Education Rankings, 2015)
		Percentage of public middle schools that achieve completeness of school facilities	(PCP, 2024); (PDER, 2015); (Pakistan Education Statistics 2021–22)
		Percentage of public high schools that achieve completeness of school facilities	(PCP, 2024); (PDER, 2015)
		Percentage of public higher secondary schools that achieve completeness of school facilities	(PCP, 2024)
	Student Participation	Percentage of OOSC in the total schools-age population	(PCP, 2024); (UNESCO, 2023); (UNICEF, 2023)
	Student Attendance	Average annual attendance percentage of all students in public schools	(PCP, 2024); (Wales, 2023-24)
	Transition	Primary to middle transition rate in public schools	(PCP, 2024); (PES, 2017-18)
		Middle to high transition rate in public schools	(PCP, 2024); (PES, 2015-16); (EMIS, 2021-22)

Domain Composition for Infrastructure & Access

Domain 2 – Learning

The Learning domain has 4 parameters and 8 indicators:

Table 4: Learning

Domain 2	Parameter	Indicator(s)	References
Learning	Grade 3 Proficiency	Percentage of Grade 3 students who can read/comprehend sentences in English	(PCP, 2024); (ASER, 2011)
		Percentage of Grade 3 students who can read/comprehend story in Urdu/Sindhi/Pashto	(PCP, 2024); (ASER, 2012-13)
		Percentage of Grade 3 students who can do 2-digit division	(PCP, 2024); (ASER, 2023)
	Grade 4 Proficiency	Mean score of Grade 4 students in English	(PCP, 2024); (Large Scale Assessment in Pakistan, 2023)
		Mean score of Grade 4 students in Urdu	(PCP, 2024); (Large Scale Assessment in Pakistan, 2023)
		Mean score of Grade 4 students in Maths	(PCP, 2024); (Large Scale Assessment in Pakistan, 2023)
	Passing Rate in Matric Examinations	Percentage of students who pass matric examinations regardless of age	(PCP, 2024)
	Adult Literacy	Percentage of population of people age 10 and above with basic literacy skills	(PCP, 2024); (Pakistan Bureau of Statistics, 2023); (Pakistan School and Living Standards Measurement, 2019-20)

Domain Composition for Learning

Domain 3 - Inclusion: Equity & Technology

The Inclusion: Equity & Technology has 3 parameters and 7 indicators:

Table 5: Inclusion: Equity & Technology

Domain 3	Parameter	Indicator(s)	References
Inclusion: Equity & Technology	Gender Parity	Ratio of girls GER against boys GER in public schools	(PCP, 2024); (PES, 2015-16)
		Ratio of girls to boy's primary transition rate	(PCP, 2024); (PES, 2015-16)
		Ratio of girls to boys passing Matric examination	(PCP, 2024)
		Ratio of female rural basic literacy against male rural basic literacy (10 years and above)	(PCP, 2024); (PSLM, 2019-20)

	School Inclusiveness for Differently Abled Students	Percentage of children with difficulty in basic functionality (seeing, hearing, walking, speaking, memory, and personal care) enrolled in school	(PCP, 2024); (ASER, 2015)
	Technology in Education	Percentage of public schools with internet connectivity	(PCP, 2024); (PES, 2024); (PSLM, 2019-20)
		Percentage of public high schools with computer labs	(PCP, 2024); (PSLM, 2019-20)

Domain Composition for Inclusion: Equity & Technology

Domain 4 - Governance & Management

The Governance & Management domain has 2 parameters and 4 indicators:

Table 6: Governance & Management

Domain 4	Parameter	Indicator(s)	References
Governance & Management	Administrative Continuity	Average tenure of Education Secretary in a province	(PCP, 2024); (State of Children in Pakistan, 2024)
	Teacher Availability	Percentage of filled teacher positions in public schools	(PCP, 2024); (Annual School Census, 2023-24)
		Percentage of single-teacher public primary schools	(PCP, 2024); (Pakistan Education Atlas, 2015)
		Average annual attendance percentage of all teachers in public schools	(PCP, 2024); (ASER, 2012)

Domain Composition for Governance & Management

Domain 5 – Public Financing

The Public Financing domain has 3 indicators:

Table 7: Public Financing

Domain 5	Parameter	Indicator(s)	References
Public Financing	N/A	Percentage of education budget in the total district budget	(PCP, 2024); (District Education Budget, Dawn, 2010)
		Education development budget spent in the district per OOSC student	(PCP, 2024)

		Percentage of budget spending on primary and secondary education in a province	(PCP, 2024); (Sindh Education Budget, 2025-26); (Punjab Education Budget, 2025-26); (KP Education Budget, 2025-26); (Balochistan Education Budget, 2025-26)
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Domain Composition for Public Financing

Source of the Data

Table 8: Source of the Data

Data Source	Organization	Data Reference Period	Frequency
National Education Management Information System	Pakistan Institute of Education	2022-2023; 2023-2024	Annually
National Achievement Test	Pakistan Institute of Education	2024	Biennially
Population and Housing Census	Pakistan Bureau of Statistics	2024	Decennial
Provincial monitoring systems	Provincial Education Departments	2024	Updated on an ongoing basis
Provincial education departments	Provincial Education Departments	2023-2024	Annually
Project to Improve Financial Reporting and Auditing (PIFRA)	Controller General of Accounts	2021-2022; 2022-2023; 2023-2024	Updated on an ongoing basis
Annual Status of Education Report (ASER)	Idara-e-Taleem-o-Aagahi	2020-2021; 2022-2023; 2023-2024	Annually
Services and General Administration Department	Provincial Education Departments	2021-2022; 2022-2023; 2023-2024	Annually
Multiple Indicator Cluster Survey (MICS)	Government of Sindh	2019-2020	N/A

Source: Authors compilation

Data Analysis Techniques

Normalization

Normalization is a statistical methodology that is utilized to rescaling the values of various indicators to a common scale commonly to a scale between 0 and 1 so that it may be compared and summed to create a composite index. When considering the Education Development Index (EDI), normalization is done so that indicators that are stated in various units (such as percentages, ratios, or counts) are normalized before they are added. Normalized data allow comparing heterogeneous indicators and transforming them into dimensionless values between 0 and 1 with best and worst values defined based on the nature of each indicator (Salawu et al., 2021).

Weighting

Weighting refers to the procedure of giving a relative weight to the various indicators when creating a composite index like the Education Development Index (EDI). Not all indicators equally affect educational performance; thus, weights enable those indicators which have more statistical or policy significance to have a greater impact on the resulting index. The Principal Component Analysis (PCA) is one of the most popular that uses statistical derivation of weights according to the explained variance of each indicator. In PCA, indicator weights are calculated by use of factor loading and eigenvalue, and the variable with higher explanatory capacity will have a bigger contribution to the final Education Development Index (Salawu et al., 2021).

Aggregation

Aggregation entails the formation of a composite index where normalized and weighted indicators are added to create an index of single dimension, which ends up being the overall Education Development Index (EDI). The indicators are made equivalent after normalization and relative importance is assigned by weighting; aggregation is done to bring together all data in order to come up with a final measure of educational performance. Aggregation is normally done with weighted average. Each dimension (e.g., access, infrastructure, teachers, equity, and results) has normalized indicators, which are summed to form dimension indices, which are further added to generate the composite EDI (Salawu et al, 2021).

Results and Discussion

The section outlines the empirical evidence that occurred due to the use of the Provincial Education Performance Index (PEPIx) to measure the level of educational performance in the district of Khyber Pakhtunkhwa during the year 2023. Using the DEPIx-based framework and a domain-based approach based on a composite index, the analysis outlines the general rankings of districts and a field-based evaluation including Learning, Infrastructure and Access, Governance and Management, Inclusion, and Public Financing. Moreover, a re-weighting exercise, which places the Learning domain first, is implemented to test the sensitivity of the district rankings and to explain the intra-provincial gaps. The results are viewed against the objectives and research questions of the study, with the specific focus on the congruency in terms of educational inputs and learning outcomes.

Overall District-Level Education Performance in Khyber Pakhtunkhwa

The results indicate a significant difference in the performance of education in the 34 districts of Khyber Pakhtunkhwa. The total PEPIx-KP score makes a range of 64.65 in Haripur, the best-performing district, to 41.05 in Kolai Palas, the worst-performing district with an average of 52.43, all being below the national trends reported with the DEPIx 2023. Such districts as Haripur, Chitral (62.84), and Abbottabad (62.33) are relatively more successful, and this result is mainly explained by better infrastructure and administrative capabilities, but none of the districts approaches the high-performance level of 70 and above. On the contrary, the lowest scores are in Kolai Palas, Upper Kohistan (41.63) and Lower Kohistan (42.61), which have poor infrastructure, access, and inclusion. Domain analysis indicates that across the districts, the Infrastructure and Access scores is generally higher than Learning, which makes it possible to state that better facilities do not always correspond to better learning outcomes. The area of learning is the weakest and the scores are almost lowest in places like Torgar and Shangla. The scores of Governances and Management are quite close (around 60-70), which indicates the standardization of administrative systems,

whereas Public Financing oscillates much, which indicates the problems of inefficient resource use.

Table 9 shows all the PEPIx scores of all the districts within KP, with the scores of the individual domains.

Table 9: Overall District-Level Education Performance in Khyber Pakhtunkhwa

Provincial Rank	Name of District	Province	Overall Index (100)	Infrastructure & Access	Learning	Inclusion	Governance & Management	Public Financing
1	Haripur	KP	64.65	84.7	51.55	70.37	70.8	52.25
2	Chitral	KP	62.83	85.43	50.2	63.62	65.55	53
3	Abbottabad	KP	62.33	83.33	49.5	69.37	66.45	46.5
4	Mansehra	KP	60.29	80.06	47.85	63.5	65.1	51
5	Malakand	KP	59.56	76.97	48.55	62.12	68.85	47
6	Karak	KP	58.95	70.15	50.9	62.12	69.6	47.75
7	Nowshera	KP	57.58	74.2	46.35	61.25	66.3	46.75
8	Mardan	KP	57.33	74.12	45.1	61	67.65	48.5
9	Lower Dir	KP	57.08	73.03	46.4	55.37	68.1	51.5
10	Charsadda	KP	56.83	72.01	45.6	59.25	69.75	47.25
11	Swabi	KP	56.61	74.85	42.6	61	67.35	49.75
12	Kohat	KP	55.89	71.67	45.75	56.75	68.4	43.25
13	Peshawar	KP	54.23	67.56	45.15	61.75	69	31.25
14	Lakki Marwat	KP	53.24	63.39	43.05	55	70.05	49.25
15	Swat	KP	53.20	68.95	40.8	58.12	67.05	42.25
16	Upper Dir	KP	53.01	63.52	43.25	52.75	69.45	49.75
17	Dera Ismail Khan	KP	52.88	62.01	44.6	55.5	66.15	46
18	Batagram	KP	52.30	62.86	45.85	46.62	64.8	47.75
19	Buner	KP	51.99	67.45	38.55	52.87	67.5	50.25
20	Hangu	KP	51.87	62.31	45.8	47.37	65.25	43.5
21	Bannu	KP	51.84	62.55	42.95	54.25	65.1	43.75
22	Tank	KP	50.71	59.78	43.25	50.25	64.8	44.5
23	Kurram	KP	49.98	55.60	42.7	50.5	67.05	47.25
24	Orakzai	KP	49.62	56.48	44.55	45.37	66	42.75
25	Shangla	KP	49.03	59.84	39.05	46.5	67.8	47
26	Khyber	KP	48.10	54.18	42.4	45.75	66.6	40.75
27	Bajaur	KP	46.51	49.7	40.45	44.75	66.75	45.25
28	Mohmand	KP	45.80	51.35	39.15	43.87	63.75	43.5
29	Torghar	KP	44.69	53.92	38	36.12	63.75	42.25

30	North Waziristan	KP	44.60	48.76	41.8	44	58.65	32.25
31	South Waziristan	KP	43.88	41.26	43.1	49.37	57	32.25
32	Lower Kohistan	KP	42.61	36.92	42.45	35	60	51.5
33	Upper Kohistan	KP	41.63	35.97	43.15	35.75	60.15	40
34	Kolai Palas	KP	41.05	29.94	41.55	38.12	57.75	54.5

Source: Author's owns work

Table 10 presents average scores at provincial levels as a perspective on general performance across domains. A graphical illustration of how provincial averages compare overall and by domain is presented.

Table 10: Provincial Average of Overall Index and Domain Scores

Provincial Average of Overall Index and Domain Scores						
Province	Overall Index Score	Infrastructure & Access	Learning	Inclusion: Equity & Technology	Governance & Management	Public Financing
KP	52.43	62.79	44.17	52.80	65.83	45.64

Source: Author's owns work

The combination of provincial averages indicates that there is an imbalance in structure: infrastructure and government spheres perform rather well, but learning outcomes are significantly inferior. Such a disequilibrium confirms the main theme of the study according to which input-based strategies have failed to translate into better educational results.

High-Performing Districts: Characteristics and Patterns

Table 11 shows that districts that are ranked at the highest level are Haripur, Chitral, Abbottabad, Mansehra, and Malakand. Such districts have continuously posted a high performance on the component of Infrastructure & Access and Governance and Management. The top three districts have an average score of more than 80 points in terms of infrastructure meaning relatively high school access, physical infrastructure, and administrative capabilities.

Even within the most performing districts, learning scores are 47 and 52. In its turn, this observation led DEPIx 2023 to place the emphasis on the idea of the fact that strong inputs do not always have learning outcomes (Planning Commission of Pakistan, 2024). This lack of connection reflects the trends of the whole country and underlines the significance of instruction quality. An overview of the Highest Performing Districts-characteristics and patterns are given in Tables 11 which show the overall index scores of the districts in KP.

Table 11: Provincial: Highest-scored Districts

Provincial: Highest-scored Districts			
Provincial Rank	Name of District	Province	Overall Index (100)
1	Haripur	KP	64.65
2	Chitral	KP	62.83
3	Abbottabad	KP	62.33
4	Mansehra	KP	60.29
5	Malakand	KP	59.56
6	Karak	KP	58.95
7	Nowshera	KP	57.58
8	Mardan	KP	57.33
9	Lower Dir	KP	57.08
10	Charsadda	KP	56.83

Source: Author's owns work

Low-Performing Districts and Persistent Regional Disparities

Table 12 shows that Districts like Kolai Palas, Upper Kohistan, Lower Kohistan, South Waziristan and North Waziristan which are located at the end of the distribution always exhibit poor performance in many areas. They have very low levels of Infrastructure and access with their scores at times scoring below 40 points which significantly hampers service delivery. However, a number of performing poorly districts have moderate scores in regard to governance and public funding which means that administrative or budgetary allocations cannot be used alone in alleviating the problem of geographic isolation, security and demographic barriers. The same patterns were also found in the DEPIx analysis on the newly consolidated and mountainous districts across the country (Planning Commission of Pakistan, 2024). Table 12 provide a general overview of the worst performance and endemic regional differences in terms of overall index scores in KP.

Table 12: Provincial: Lowest-scored Districts

Provincial: Lowest-scored Districts			
Provincial Rank	Name of District	Province	Overall Index (100)
25	Shangla	KP	49.03
26	Khyber	KP	48.10
27	Bajaur	KP	46.51
28	Mohmand	KP	45.80
29	Torghar	KP	44.69
30	North Waziristan	KP	44.60
31	South Waziristan	KP	43.88
32	Lower Kohistan	KP	42.61
33	Upper Kohistan	KP	41.63
34	Kolai Palas	KP	41.05

Source: Author's owns work

Ranking Sensitivity and Comparative Performance Categorization

Table 13 analyzes the structural contribution of the Learning domain to the Provincial Education Performance Index (PEPIx-KP) through sensitivity testing of domain weights. The results show that increasing the weight of Learning causes only minor shifts in district rankings (mostly ± 1 position), indicating that learning deficiencies are widespread across the province. However, districts such as Charsadda, Lakki Marwat, Batagram, Hangu, and Orakzai slightly improve their rankings when learning is prioritized, suggesting that stronger learning outcomes can enhance overall district performance. Conversely, the districts that fall in rank seem to be more dependent on the infrastructure, access or government than the actual learning outcomes. The results highlight how infrastructural development does not significantly increase performance where literacy, numeracy, and student achievement levels are low. This is in line with the report by DEPIx 2023 that has noted Pakistan to face a learning crisis instead of low access as the main challenge to education. Methodologically as composite indices are sensitive to weighting in the domain, the focus on outcome-based indicators like learning would make the index more representative of education quality. The findings therefore support the need to adjust education policies in Khyber Pakhtunkhwa to focus on improvement of the quality of teaching, teacher performance and student learning outcomes in a bid to make significant changes in the district rankings and the overall education performance.

Table 13: Ranking Change After Learning Prioritization (PEPIx-KP 2023)

District	Rank (Standard Weight)	Rank (Learning 40%)	Rank Change (+/-)	Movement Direction
Haripur	1	1	0	No Change
Chitral	2	2	0	No Change
Abbottabad	3	3	0	No Change
Mansehra	4	4	0	No Change
Malakand	5	5	0	No Change
Karak	6	6	0	No Change
Nowshera	7	7	0	No Change
Mardan	8	8	0	No Change
Lower Dir	9	9	0	No Change
Charsadda	11	10	+1	Moved Up
Swabi	10	11	-1	Moved Down
Kohat	12	12	0	No Change
Peshawar	13	13	0	No Change
Lakki Marwat	15	14	+1	Moved Up
Swat	14	15	-1	Moved Down
Upper Dir	16	16	0	No Change
Dera Ismail Khan	17	17	0	No Change
Batagram	19	18	+1	Moved Up
Buner	18	19	-1	Moved Down
Hangu	21	20	+1	Moved Up
Bannu	20	21	-1	Moved Down
Tank	22	22	0	No Change
Kurram	23	23	0	No Change
Orakzai	25	24	+1	Moved Up

Shangla	24	25	-1	Moved Down
Khyber	26	26	0	No Change
Bajaur	27	27	0	No Change
Mohmand	28	28	0	No Change
Torghar	29	29	0	No Change
North Waziristan	30	30	0	No Change
South Waziristan	31	31	0	No Change
Lower Kohistan	32	32	0	No Change
Upper Kohistan	33	33	0	No Change
Kolai Palas	34	34	0	No Change

Source: Author's owns work

Table 14 provides a comparison of the district performance classification within PEPIx-KP (2023) and the District Education Performance Index (DEPIx) 2023 in Khyber Pakhtunkhwa and shows that when more weight is placed on the Learning domain, more districts are classified as low-performing. According to PEPIx-KP, the number of districts with low performance (the score is less than 55) is 22, which is lower than 18 districts in the DEPIx 2023 test, and the number of districts in the middle category decreases, and no district is high or very high performers in both indexes. The change to this is that those districts, which were formerly rated as average based on better infrastructure, access or governance scores are now lower ranked in the ranking when learning outcomes are given more weight which shows that poor learning outcomes are the main limitation in the education system of the province. The findings align with the DEPIx 2023 report, which identifies Pakistan's education challenge as a learning crisis despite improvements in access and inputs. From a methodological perspective, emphasizing learning makes the composite index more outcome-oriented, indicating that improvements in instructional quality, student assessment, and foundational skills would directly enhance district performance and overall education outcomes. Table 14 provides empirical support to the need to shift the policy focus towards learning-based reforms rather than input-based expansion. Since learning is the key deliverable of the education system, its improvement will be multiplied throughout the district performance.

Table 14: Comparison: PEPIx-KP (2023) vs DEPIx 2023 National Report

Performance Category	Score	PEPIx-KP (No. of Districts)	DEPIx 2023 (KP No. of Districts)
Very High	80 to < 100	0	0
High	70 to < 80	0	0
Medium	55 to < 70	12	16
Low	0 to < 55	22	18

Source: Author's owns work

Implications for Learning-Prioritized Analysis

The initial outcomes of PEPIx-KP are an essential part of the weighting case that was presented in this paper. The noted mismatch between large-scale infrastructure or administration and small learning points to the fact that the areas that persist in enjoying the most due to the access-oriented investment would suffer in case the real learning outcomes were to take precedence. On the other hand, those regions with relatively better learning performance and low inputs would be improved when new index takes the actual learning performance and scope as weights.

This sensitivity indicates the necessity to explicitly link the index construction to the policy aims, which is one of the main restrictions realized in the very structure of the DEPIx (Planning Commission of Pakistan, 2024).

Table 15: Summary: Objectives, Methods and Findings

OBJECTIVES	METHODS	FINDINGS
To measure district-wise education performance using a composite index (PEPIx-KP)	Construction of Composite Education Performance Index using DEPIx 2023 indicators; normalization and weighted aggregation method.	Significant variation exists across districts; top-performing and low-performing districts show wide performance gaps.
To highlight intra-provincial disparities in education outcomes	Domain-wise analysis (Learning 40%, Infrastructure & Access 25%, Governance & Management 10%); district ranking and comparative analysis.	Learning domain shows strongest variation and determines overall district ranking under prioritized weighting scheme.
To provide evidence for resource targeting and education reforms	Re-weighting simulation (Learning increased from 30% to 40%); comparative ranking analysis; inter-district gap assessment.	Learning-prioritized model changes ranking positions; some economically strong districts do not rank highest in education performance.

Source: Research compilation

Conclusion And Recommendation

The methodological framework of the District Education Performance Index (DEPIx) 2023 inspired this study to use a Provincial Education Performance Index (PEPIx-KP) in measuring education performance at the district levels of Khyber Pakhtunkhwa (KP). Results provide evidence of significant disparities within provinces with moderate to low levels of general outcomes in districts. It was found that no district in KP attained high or very high performance, with most districts performing at low levels. While several districts showed relatively good performance in Infrastructure & Access and Governance & Management, this did not translate into better learning outcomes, which remained the weakest performing domain across the province. This pattern is similar to what was found at the national level in DEPIx 2023 highlighting concerns about the inadequate effectiveness of education inputs in improving learning outcomes. Geographic and structural inequalities are very stark. Mountainous, remote, and districts in the merged area always lag on most of the domains particularly infrastructure availability, inclusion, and learning outcomes. Relatively urban and settled districts perform better overall but even in these areas learning achievement is modest at best indicating a province-wide learning crisis.

The findings suggest that the problem of education in Khyber Pakhtunkhwa cannot be seen as a problem of access or administrative growth, but the inability to transfer resources and infrastructure in enhanced learning outcomes. Infrastructure and governance systems have improved, but this has not been matched by corresponding improvement in student performance due to the lack of any district rating highly in terms of composite index. The implementation of the DEPIx methodology on a provincial level illustrates that rankings of districts are susceptible to weights of domains, and districts who used to be ranked higher on a domain basis displays structural inefficiencies when learning is put into focus. This points out that performance

measurement has impact on interpretation of policy and a gap that has always existed between good input measures and poor learning outcomes. The results indicate that the education funding has extensively enabled physical growth and administration frameworks and overlooked the teaching quality, instructional performance, and foundational skills development. Therefore, education problem in KP is more of a learning crisis than access crisis. The paper highlights the transition of input-based planning to do outcome-based governance, which puts the student achievement and learning outcomes as the measure of sustainable or effective improvement on the education system as the main focus of budgeting priorities, district targeting, and policy change.

The research has several implications in the Pakistan education policy analysis and applied research. It, first, extends the District Education Performance Index (DEPIx) framework to the provincial level, thus, allowing us to examine the intra-provincial inequalities in districts in KP in detail. Second, the research has improved the methodology of the study by including sensitivity analysis to test the implications of alternative domain prioritization thus enhancing transparency and emphasizing the normative assumptions that underline the creation of composite indices. Lastly the results can be used to offer evidence-based information that may facilitate policy planning in districts and enable a more precise distribution of educational resources within KP, ultimately leading to a better and fairer policy design in education.

This study has some policy implications for education planning and reform in KP. The prevalence of low and medium-performing districts indicates that standardized and province-wide interventions will not be effective. Dissimilar districts are limited to different things such as geographical, capacity-related, and demographical ones, and therefore different policy reactions are required. Low results of learning in the districts indicate that the enhancement of classrooms has not been successfully accomplished even though the present investments in infrastructure, governance, and financing. This underscores the futility of the utilization of the resources without a sound accountability system between spending and learning outcomes. The relative power of the governance indicators and poor learning performance are evidence that administrative capacity is not the determinant of educational improvement. The further improvement of governance is not likely to lead to meaningful increases in the learning unless appropriate adjustments are undertaken to the practices of pedagogy, teacher support, and assessment. To conclude, these results indicate how important the articulation of policy priorities is during the use of composite indices in decision-making. This paper will show that various weighting assumptions can cause diverse interpretation of the district performances and that such differences have a direct implication on resource allocation and prioritization in reforms.

According to the findings, the next policy recommendations can be presented:

- Foundational literacy and numeracy must be made the primary performance targets in provincial education policies. Planning and budgeting activities must also associate investment with demonstrable learning gains instead of majorly investing in infrastructure growth.
- Underperforming and geographically disadvantaged districts should be given specific support packages to deal with context-relevant limitations, such as the difficulty of providing teachers to them, the accessibility of schools, and student retention.
- Invest in training, coaching of teachers and application of pedagogical practice in the classes in those districts wherever the infrastructure and governance indicators are already rather strong but the learning outcomes are weak.

- The provincial monitoring systems should also entail regular learning assessment as part of the district performance reviews such that the administrative and financial performance is evaluated together with student learning outcomes.
- Instead of accepting the results of indexes as fixed outcomes, policymakers should utilize education performance indices as analytical tools and test other policy priorities and their impacts on district planning.

The recommendations are also in line with the strategic direction that was given in the DEPIx 2023 report and are formulated to contextualize the findings of the DEPIx report to Khyber Pakhtunkhwa.

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