

# A Comparative Analysis of Performance across Schools in Uttar Pradesh

Trishla Singh<sup>1</sup>

Supervised by:

Professor Oindrila De  
Professor Vikram Dayal

## Abstract

Equitable and quality education is one of the key objectives as well as challenges of the current century. Given the importance of effective school education and learning outcomes in the policy discourse in India, it is essential to understand the strengths and weaknesses of our current education system. The paper at hand aims to contribute to this body of research by doing a comparative analysis of performance across different types of schools (i.e government, aided and private) for the year 2017-18 in the state of Uttar Pradesh. The study leverages school level data from UDISE – a rich comprehensive MIS developed and published by the Ministry of Education. To assess quality of schooling, it creates indices of infrastructure and monitoring using a wide range of variables by employing the Factor Analysis technique. Regression analysis is conducted to understand what determines higher levels of monitoring and infrastructure in schools and how it compares across different school categories. To control for varying levels of development in different districts, 3 broad district categories have been identified using district level ranking computed by the Economics and Statistics Division of the State Planning Institute, Uttar Pradesh. The regression results show that aided and government schools continue to lag behind in terms of infrastructure. Government schools, however, are forerunners in terms of monitoring efforts, given certain policy mandates - indicating lack of proactive effort to undertake monitoring in aided and private schools. Student performance significantly depends both on infra and monitoring levels, particularly at the upper primary level - suggesting the need for policy and behavioural interventions that would drive schools to invest in infrastructure and regular monitoring and supervision mechanisms. At the primary level, different categories of school show no significant differences in student performance. However, these results change when we look at student results at the upper primary level wherein aided schools are seen to be laggards, showing lower levels of performance as compared to private and government schools.

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<sup>1</sup> Officer Trainee, Indian Economic Service, 2022  
Contact Details : singhtrishla@gmail.com

## Introduction

*“Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”*

The 4<sup>th</sup> Sustainable Development Goal of the United Nations lays out the key path essential to overcome global challenges and ensure for all a sustainable future by 2030. This development agenda calls for countries to “build and upgrade education facilities that are child, disability and gender sensitive, and provide safe, non-violent, inclusive, and effective learning environments for all.” Organisations around the world, including the Organisation for Economic Co-operation and Development (OECD), United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Bank, have been extensively working on identifying instrumental areas that improve the design and efficiency of school education and create an environment conducive to student learning and growth. Such studies and reports have not only been tracking performance of countries in undertaking effective education interventions, but also provide crucial inputs and recommendations to countries steering their path towards inclusive and high quality education. A lot of these reports in recent times have brought out how India has been a laggard in terms of quality education attainment.

India has over 17% of the world’s population but more than 30% of the world illiterates, making it home to the world’s largest illiterate population. (UNESCO Global Education Report 2017). With one of the largest education systems in the world, India comprises around 9.7 million teachers employed across 1.5 million schools with over 260 million students (UDISE+ 2019-20). India now has enrolment rates of around 97% at the elementary level and 90% at the upper primary level. However, attending school doesn’t necessarily imply better school quality and higher learning levels (UNESCO 2014). This has also been validated in the Indian context by results from the ASER reports over the years.

Within the Indian school education space, there exists wide disparity among different ownerships of government, private, aided, local body schools, etc. As per the ASER 2020 report, 2013 onwards, all states in India have witnessed an uptake in private school enrolment and share of private schools. Several studies (ASER ; Tooley and Dixon, 2005) note that achievements and quality in private schools are significantly higher than those in government schools. V Santhakumar from Azim Premji University, in his article, supports the case for government schools in the Indian context and the need for making them efficient and effective. He elaborates how the characteristic scattered population in many villages in India makes it infeasible for private schools to be setup there. This, along with the hassles and financial unviability of universal monitoring of schools by the government make the government schools indispensable in the Indian schooling landscape. Thus, it becomes imperative to understand what drives efficiency in private schools vis-à-vis public schools and make effective timely intervention for the same.

With thriving competition from private schools, there have been significant efforts from the Indian Government to offer improved facilities and infrastructure in government schools. A World Bank Group study by Barrett et al (2019) does a comprehensive review of “The Impact of School Infrastructure on Learning” and finds a sizeable impact of physical learning environments on

student cognitive abilities and learning outcomes even after controlling for students' socioeconomic background and other relevant covariates.

Besides financing infrastructure needs, the most remarkable intervention of the Indian government in the education sector has been the Right to Education Act, 2009 to ensure education for all. A key node of the Act has been its focus on regular and adequate monitoring of student and school performance through a decentralised mechanism of school governance. This has been incorporated in the ruling by making the provision for School Management Committees (SMC). SMC formulation would address the need for bringing in accountability and transparency in the school affairs by conducting supervision of school finances, management, infrastructure and academic progress of children. The diverse representation mandate of the SMC (three fourth representations of the parents, 50% women, local body representation) ensures wider community participation, instils a sense of ownership and creates a network between the school and community.

Another component of the RTE Act provides for facilitation of Special Training programs for “A child 6-14 years of age (who) has never been enrolled in an elementary school or if after enrolment has been absent from school without prior intimation for reasons of absence for a period of 45 days or more”. Special Training programs also ensure a better mechanism of student assessment by not simply pitting students against each to rank them but providing tailor made assistance to motivate students through proper feedback, support and cooperation.

### Selection of Uttar Pradesh

If Uttar Pradesh were a country, it would rank fifth among the world's most populous countries. A fourth of its 200 million plus population, are aged between 5 and 14 years – forming India's largest child population. The sheer size makes UP a critical study area and merits a good deal of attention. As per Census 2011, UP's literacy rate of 69.27% is the eighth lowest in India. There has been significant improvement in the literacy rate by over 13% points over a decade starting 2001, but this improvement has not been uniform and characterised by wide regional disparities. UP also has constantly been ranked among the lowest in terms of performance on social infrastructure indicators. (Timilsina, Sahoo et al, 2022).

The government, taking cognizance of this situation, has tried to channel additional funds towards improving the education status in the state. For the year 2014-15, UP spent Rs13,000 per elementary school student, much higher than the India average of Rs.11,000. ASER reports have shown an improvement in students reading and mathematics performance, however this improvement has been restricted to private schools, while government schools continue to lag behind.

This paper has thus tried to take a closer look at the performance of key education metrics across all districts of UP. Leveraging the comprehensive rich school level data from DISE, the paper employs the technique of exploratory factor analysis to create measures on the quality of infrastructure and level of efforts undertaken for monitoring and supervision, both computed at the school level. To get a deeper insight into the variation in performance across these metrics, categories of districts have been identified using an elaborate list of indicators defining fundamental development aspects. Further, the paper tries to identify what variables or features at the school level have an impact on these factors of monitoring and infrastructure.

Taking the inspection further, the paper analyses the impact of these indices on student performance at the primary as well as upper primary level. The passing rates of students at both levels are regressed on these indices and other important covariates.

The key component of the paper is to understand the differences in school facilities such as infrastructure as well school management efforts to conduct monitoring across different types of ownership – government, private and aided. This comparison will not just create greater accountability for different management categories but also point out key lessons that can be learnt by the non-performing group from the others.

The motivation for this study comes from the fact that no comprehensive empirical analysis has been done for the state of UP, covering all districts at such a disaggregated school level. The dual comparison across district types and management categories ensures the results are not biased by development level of a district and can be used for valid policy interventions. Finally, the access to a rich huge source of data from UDISE allows investigation into a wide range of questions and comparison groups, enhancing robustness of the results.

The rest of the paper is structured as follows. Section 2 talks about the existing literature in this area. Section 3 gives a description of the data and the variables used in the analysis. Section 4 explains the methodology used to estimate the index of infrastructure and monitoring. Section 5 brings out the results of the empirical analysis which examines the determinants of and comparison of the indices and student performance across different categories of managements and districts. Section 6 summarises the key findings with certain policy implications.

## **Literature Review**

A wide range of study has been conducted to assess what are the key determinants of improved learnings in schools. Focus has been directed towards understanding student and teacher perception of school facility and their performance to the same by way of primary and secondary research.

A rich body of literature exists on a deep-dive in the performance and condition of public schooling by evaluating the status of different parameters of school profile, but most of these studies are concentrated outside India (Visscher 2001) (Beata Merickova et al, 2020). A lot of these studies find wide disparities in the academic performance of students across public and private schools on account of inadequate teaching and learning resources in public schools (Atuahene et al, 2019). Singh & Sarkar (2015), also find that students from private unaided schools perform significantly better than those in government schools.

In the Indian context, evidence has been found on significant differences in the quality of inputs, including teacher qualification, classroom infrastructure and patterns of time use between private and public schools (Muralidharan and Sundararaman, 2013). Moreover these differences have been found to have significant bearings on learning outcome and test scores of students. Gouda et al (2013) validate these findings at the primary school level as well using IHDS data. They employ the factor analysis technique to construct indices of school infrastructure, cost of schooling and student performance and show how private schools continue to be forerunners in all the three metrics. Additionally, they find a significant impact of the former two indices on the performance factor.

Besides tangible inputs like infrastructure and cost, unobservable metrics like teacher beliefs and attitude as well as student perception about their teacher's instructional quality have also been found

to play a key role in impacting student learning outcomes (Konica Sehgal, 2022). The highest levels of achievement in this case are seen in private unaided schools, followed by government schools, private aided schools, and tribal-state welfare schools.

It has been stressed upon in multiple discussions and studies how learnings at the primary level in school go a long way in defining future cognitive abilities and skills of students and hence their enrolment and performance in higher education. Narayan and Mooji (2010) argue that poor infrastructure such as lack of proper classrooms and ICT and inadequacy of training programs deteriorate education quality in government primary schools.

Despite widespread evidence on the impact of such key inputs on student learning, most government schools continue to be plagued by issues of weak governance and monitoring systems, high-teacher absenteeism, low classroom activity and discriminatory attitudes of teachers. (Chaudhury et al., 2006; Glewwe and Kremer, 2006; De et al., 2011)

When conducted on a disaggregated level, studies show how private school advantage in scores is not robust when controlled for observed student and school characteristics and other covariates (Jammu and Kashmir- Ahmad Sofi et al, 2017; Goyal and Pandey, 2012). There is also evidence from Chennai of parents' perception that private schools are better at facilitating parent involvement and parent communication with regards to their wards' performance (Rashmitha and Jasmin, 2018).

Most of the studies so far have been based on primary survey data and focused on a small research area. The analysis of the educational system in India and of government-private primary schools are often hampered due to the unavailability of data (Mehta, 2005).

The study at hand tries to do a broad deep-dive analysis for the state of Uttar Pradesh by leveraging the rich comprehensive data from UDISE. It aims to do a comparison of key school level metrics across different managements, including government, private and even aided schools. The results are further enhanced by looking at the variation across categories of districts and taking a closer look at the impact of a broad spectrum of variables including teacher quality, monitoring efforts by school, funds spent on development and quality of infrastructure.

## **Data and Variables**

The paper uses cross section school level data for the state of Uttar Pradesh for the year 2017-18. The district classification information has been taken from "District- wise Development Indicators, Uttar Pradesh" 2018 report published by the Economics and Statistics Division of the State Planning Institute, Uttar Pradesh.

The school level data has been sourced from Unified District Information System for Education (UDISE) – an Educational Management Information System under the Ministry of Education. The analysis at hand leverages the UDISE database to study information on school management, physical infrastructure, monitoring levels, school profile and examination results.

### **About U-DISE**

Unified District Information System for Education (UDISE) was initiated in 2012-13 by the Ministry of Education, integrating information on elementary and secondary education. This

MIS provides a very rich resource covering detailed comprehensive data on more than 1.5 million schools, over 9.6 million teachers and 264 million children. This huge source of information has had wide applications in the planning arena, from optimising resource allocation to curating tailor-made education interventions through policy programs. Data is collected at the school level through a Data Capture Format on a wide array of fields. Below are some snapshots of the data capture format –

**Data Capture Format<sup>1</sup>**

**The Unified District Information System for Education (U-DISE)**

Reference date: As on 30<sup>th</sup> September

U-DISE Code: 

State Code	District Code	Block Code	Village/Ward code				School Code			

Location: 

Latitude					Longitude				
					N				E

**Section 1: School Profile (Location, Structure, Management and Medium of Instruction)**

1.1 School name (in capital letters): \_\_\_\_\_

1.2 Location of the school: [Rural = 1, Urban = 2]

1.3 Name of the village (in rural areas)/Ward Number (in urban areas): \_\_\_\_\_

1.4 Name of the habitation (in rural areas)/Mohalla or equivalent urban unit (in urban areas): \_\_\_\_\_

1.5 Pin Code:

1.6 Name of the Village/Gram Panchayat (in rural areas only): \_\_\_\_\_

1.7 Name of the Cluster Resource Centre (CRC): \_\_\_\_\_

1.8 Name of the Community Development (CD) Block/Mandal/Taluka: \_\_\_\_\_

1.9 Name of the Educational Block/Mandal/Taluka: \_\_\_\_\_

1.47 Details of visits to the school during the previous academic year:

(a) Number of visits for academic inspections

(b) Number of visits by CRC Co-ordinator

(c) Number of visits by Block level officer (BRC/BEO)

**(iii) Profile of Schools with Secondary / Higher Secondary Section**

1.48 Whether School Management Committee (SMC) and School Management and Development Committee (SMDC) are same in the school? [Yes=1, No=2]

If 'No', give the following details about the composition of the SMDC;

(a) Whether School Management and Development Committee has been constituted [Yes=1, No=2]

If yes, provide information in table below:

Sl. No.	Details of Members/Representatives	Male	Female
(i)	Total Members		
(ii)	Number of Representatives of Parents/Guardians/PTA		
(iii)	Number of Representatives/nominees from local government/urban local body		
(iv)	Number of members from Educationally Backward Minority Community		
(v)	Number of members from any Women's Group		
(vi)	Number of members from SC/ST community		
(vii)	Number of nominees of the District Education Officer (DEO)		
(viii)	Number of members from Audit and Accounts Department (AAD)		
(ix)	Number of Subject experts (one each from Science, Humanities and arts/Crafts/Culture) nominated by District Programme Co-ordinator(RMSA)		
(x)	Number of teachers (one each from Social Science, Science and Mathematics) of the school		
(xi)	Vice-Principal/Asst. Headmaster, as member		
(xii)	Principal/Headmaster, as Chairperson		
(xiii)	Chairperson (If Principal/Headmaster is not the Chairperson)		

## Variables

This section gives information about the key dependent variables and explanatory variables used in the analysis. Some of the variables are taken directly from the data, while a few of them have been created as indices using Factor Analysis. These indices are first studied as dependent variables to understand their determinants and then as explanatory variables in the final regression to assess their impact on student passing rate at the primary and upper primary level. The following section explains each of these indices, their component variables and other explanatory variables used in the analysis.

### 1. Index of Infrastructure

A composite index for infrastructure has been created to represent the availability and quality of facilities in schools. Basic amenities such as proper toilets, electricity, playgrounds form an essential component of the learning environment for a student. These constitute key factors determining drop out decisions, cognitive ability, girl child enrolments as well as physical and mental health of students. Moreover, with increasing penetration of digital technology in higher education and employer industries, it becomes

imperative for students to be familiarised with working on computers and software. The inclusion of such interventions as part of the National Education Policy is also suggestive of the importance the government lays on digital augmentation of school education. As per a study in UK, 16% of the variations in primary students' performance is explained by key school infrastructure components. The below mentioned variables from U-DISE have been used to create the index on infrastructure –

- Functioning Toilets in the school
- Availability of Power
- Library Facilities availability
- Adequate Water facilities
- Presence of ramps
- Provision of medical aid in school
- Whether computer aided learning provided
- Presence of playground in school premises
- Whether provision of essential books facilitated by school

## **2. Index of Monitoring and Supervision**

A composite index for monitoring has been created to assess the efforts taken at the school level to keep track of the functioning and governance of student related matters. The index incorporates a key node of the Right to Education Act i.e School Management Committees which have been put in place with a view to encourage active and wider community participation in school governance. This creates a decentralised mode of school monitoring, acts as a check on school management actions and also inculcates a positive attitude of parents towards the school by ensuring a diversified membership. Besides these committees, a regular and periodic method of evaluation through the CCE (Continuous and Comprehensive Evaluation) prevents gaps and losses in learnings and enables the students to not be left behind in grasping the syllabus. Such evaluation also helps teachers to better plan their assistance and direct greater focus on those sections of students who are facing greater challenges in absorbing the material. The holistic nature of evaluation breaks away from the traditional one time marks based approach assessed in the form of annual final examinations. Any interventions by the school essentially requires proper data on performance levels of students and hence the index additionally incorporates variables on pupil record maintenance by schools. Finally, the index also takes into account school efforts in conducting Special Training Programs for students to ensure all students are at par and no child is left behind in education and knowledge attainment.

Following set of variables from U-DISE have been used to create the index on monitoring –

- Whether School Management Committee has been constituted
- % of female members in the SMC

- % of members of SMC representing parents/guardians of students
- Whether SMC prepares the School Development Plan
- Is CCE(Continuous and Comprehensive Evaluation) implemented
- Are Pupil Cumulative Records maintained
- Are Pupil Cumulative Records shared with parents
- Whether students attending any Special Training Program

### **3. Dependent Variable - Student Results**

To understand determinants of student performance, the study uses the % of primary level (Class 5) and Upper Primary (Class 8) students scoring above passing marks, as the dependent variable. This variable has also been taken from the U-DISE file on student performance.

### **4. District Categories**

The study tries to observe difference in school performance across backward and advanced districts in the state. To get a comprehensive ranking of districts, the study leverages the district level scores from the District-wise Development Indicators - UP 2018 report, prepared and published by the Economics and Statistics Division of the State Planning Institute, Uttar Pradesh. The report computes a grading for each of the 75 districts, based on aggregated measures of the following fundamental development aspects

Health	Education	Infrastructure	Agriculture	Animal Husbandry & Fisheries
Industry	Banking & Finance	Co-operation	Income	Employment & Manpower

This aggregate score has then been used in this paper to classify districts into three categories :-

- High Rank districts– Above 70<sup>th</sup> percentile score
- Medium Rank districts– Between the 40<sup>th</sup> and 70<sup>th</sup> percentile score
- Low Rank districts – Below the 40<sup>th</sup> percentile score

For the given analysis, High rank districts is taken as the base category and the following 2 dummy variables are used to capture the other categories–

<i>D2</i>	<i>Takes value = 1 for districts in Medium category, 0 otherwise</i>
<i>D3</i>	<i>Takes value = 1 for districts in Low category, 0 otherwise</i>

## **5. Management Categories**

There are 3 types of school management in our U-DISE data sample – Government, Government Aided and Private. Dummy variables were created for each of these, with government schools taken as the base category.

<i>M2</i>	<i>Takes value =1 for Government Aided Schools, 0 otherwise</i>
<i>M3</i>	<i>Takes value = 1 for Private Schools, 0 otherwise</i>

## **6. Other Explanatory Variables**

*SMC Meetings* – Continuous variable giving the number of SMC Meetings conducted in the year

*SMC Parents participations* - % of members of SMC representing parents/guardians of students

*Inspections* – Variable capturing no. of visits made to the school for academic inspections in the year

*Graduate Teachers* - % of teachers in the school who are graduate or above

*Professionally Qualified Teachers* - % of teachers who have some professional qualification

*Development Expenditure* – Money spent per head by the school on development initiatives

*Road Approach* – Categorical variable taking value =1 in case of absence of proper road connectivity

# **Methodology**

The UDISE database provides a wide variety of variables describing the amenities the school provides as well as the efforts taken by it to conduct regular supervision and evaluation of the students. The list of these variables has been enumerated in the data section above.

Since each of these set of variables gives a broad idea about the infrastructure and monitoring, respectively, in the school, it makes greater sense to club them to form a measure of these metrics instead of considering each of their impacts individually.

Aggregating the different variables to form a composite factor entails assigning weights to each of those component variables. There would be considerable bias and a lack of accuracy in formulating weights on a subjective basis. In order to avoid this challenge, the paper employs the technique of factor analysis. Factor analysis also addresses the problem of high degree of complementarity among the variables.

## **Factor Analysis**

Exploratory factor analysis gained rapid popularity as a fundamental tool in theoretical analysis after it was first used by Spearman (1904). It analyses correlation among a set of observed variables and uses it to construct latent factors. The technique involves selecting a broad range of variables, based on prior

expectation and review of literature, to represent a factor. The factor loadings, depicting the correlation between the individual variable and the factor, are used to construct the factor.

For each of the 2 metrics – infrastructure and monitoring, exploratory factor analysis is conducted to create the index at the school level for the given year 2017-18.

The first factor contributes the maximum proportion to the overall variance and the contribution keeps decreasing for the subsequent factors. Kaiser (1974) has suggested a criteria to decide how many factors should be retained in formulation of the index. As per his recommendation, all factors with an Eigenvalue < 1 should be dropped.

Factor analysis furnishes factor loadings for each of the variables which can be used as weights to create the single composite index. In order to get accurate factor loadings, a rotation procedure is followed which gives the weights suggesting relative importance of each variable in the overall factor. A higher factor loading would mean a higher level of correlation between the variable and the factor and thus a higher relevance to defining the particular factor. Additionally, the sign of the factor loading indicates the direction of the impact the variable has on the factor, wherein a negative sign would mean an inverse impact on the factor.

The results of the factor analysis can be seen below.

### Index of monitoring

Factor	Eigenvalue	% of variance explained	Cumulative %
Factor 1	3.91050	48.88	48.88
Factor 2	2.13272	26.66	75.54

Variable	Rotated Factor Loadings	
	Factor 1	Factor 2
Existence of School Management Committee (SMC)	0.7779	-0.1064
% of female members in the SMC	0.8630	-0.1479
% of members of SMC representing parents/guardians of students	0.8585	-0.1469
Whether SMC prepares the School Development Plan	0.8375	-0.0815
Is CCE implemented	-0.0686	0.8697
Maintenance of Pupil Cumulative Records maintained	-0.1283	0.9604
Sharing Pupil Cumulative Records shared with parents	-0.1276	0.9610
Whether students attending any Special Training Program	0.7276	-0.1562

The tables above show that Factor 1 and 2 are significant having Eigenvalue  $> 1$ . These factors cumulatively explain 75% of the overall variance. The variables constituting these factors all have the expected positive sign corresponding to their significant factor loadings. Wherever the signs are negative, the factor loading magnitude is quite small, indicating a very low correlation with the factor.

*Inference – A school which constitutes a school management committee, with adequate representation from all stakeholders, working on discussing and formulating the development plan for the school has a higher level of monitoring. Besides having a well-functioning SMC, implementing continuous and comprehensive evaluation with proper student records maintenance and provision of special training also contribute to better monitoring and supervision.*

### Index of infrastructure

Factor	Eigenvalue	% of variance explained	Cumulative %
Factor 1	1.77845	19.76	19.76
Factor 2	1.21592	13.51	33.27
Factor 3	1.06045	11.78	45.05

Variable	Rotated Factor Loadings		
	Factor 1	Factor 2	Factor 3
Functioning Toilets in the school	-0.0771	-0.2670	0.5378
Whether computer aided learning provided	0.1033	0.7297	0.1937
Availability of Power	-0.0828	0.7465	-0.1981
Library Facilities availability	0.6046	0.1500	0.0280
Presence of playground in school premises	0.3627	0.1791	-0.3137
Adequate Water facilities	0.4910	-0.1011	-0.4416
Provision of medical aid in school	0.6155	0.1150	0.2310
Presence of ramps	0.7064	-0.1154	-0.1339
Whether provision of essential books facilitated by school	0.0605	0.0731	0.6500

The tables above show that Factor 1, 2 and 3 are significant having Eigenvalue  $> 1$ . The 3 factors together account for 45% of the variance. The variables constituting these factors all have the expected positive sign corresponding to their significant factor loadings. Wherever the signs are negative, the factor loading magnitude is quite small, indicating a very low correlation with the factor.

*Inference – A school with higher endowment of amenities like functioning toilets, water and electricity provision, library and playground facilities, proper ramps and greater computer and books facilitation has a higher level of infrastructure quality.*

# Empirical Analysis and Results

Through this section, the study aims to understand the key factors that have an impact on the level of infrastructure and monitoring as well as student performance across schools. This is done by the use of ordinary least square (OLS) method of regression. As the regression estimates are based on cross sectional data available for schools in UP, it may pose the problem of heteroscedasticity which could bias the results. Therefore robust standard errors have been used to take care of the problem. Further the standard errors have been clustered at the district level to prevent any bias.

In each of the regressions, the district and management dummies have been used to understand how the different study metrics vary across categories of districts ranked by the UP DES and types of management.

The three estimation equations along with there are results explained below –

## 1. Index of Monitoring and Supervision

$$\text{monitor\_idx}_i = \beta + \beta_1 D_2 * M_2 + \beta_2 D_2 * M_3 + \beta_3 D_3 * M_2 + \beta_4 D_3 * M_3 + \beta_5 \text{SMC\_Meets}_i + \beta_6 \text{Inspections}_i + \beta_7 \text{Grad\_Teachers}_i + \beta_8 \text{ProfQual\_Teachers}_i + \beta_9 \text{PerDevExp}_i + \epsilon_i$$

<i>Variable</i>	<i>Description</i>
<i>monitor_idx</i>	The index for monitoring quality
<i>D<sub>2</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in medium ranked districts
<i>D<sub>2</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in medium ranked districts
<i>D<sub>3</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in low ranked districts
<i>D<sub>3</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in low ranked districts
<i>SMC_Meets</i>	Number of meetings by the School Management Committees in the year
<i>Inspections</i>	Number of Visits for Academic Inspections in the Year
<i>Grad_Teachers</i>	% of teachers who are graduate or above
<i>ProfQual_Teachers</i>	% of teachers with professional qualification
<i>PerDevExp</i>	Per Capita Development Expenditure

## Results

Variable	Coefficient	Standard Error	P > t
D <sub>2</sub> *M <sub>2</sub>	-.3194954	.1138953	0.006**
D <sub>2</sub> *M <sub>3</sub>	-.7378629	.0883407	0.000**
D <sub>3</sub> *M <sub>2</sub>	-.3323612	.0688745	0.000**
D <sub>3</sub> *M <sub>3</sub>	-.7538161	.0771211	0.000**
SMC_Meets	.0050109	.0007529	0.000**
Inspections	.0027358	.0006235	0.000**
Grad_Teachers	.0842555	.0407181	0.042*
ProfQual_Teachers	.1415953	.0536499	0.010**
PerDevExp	.1065222	.0179891	0.000**

\*\*Significant at 1% level of significance as  $p < 0.01$

\*Significant at 5% as  $p < 0.05$

- The base dummy category here is Government schools in high ranked district – since all interaction terms have significant negative coefficients, this shows that government-aided and private schools in medium and low districts conduct lower levels of student monitoring and supervision. Higher and more focussed state interventions in education and subsequent policies create mandates for government schools to carry proper student monitoring. Since, such policy directives are not binding on private and government aided schools, they tend to fare lower on this record, indicating lack of proactive effort to monitor students on a regular periodic basis.
- Among the included interaction categories, the level of monitoring is observed as :

**Private in low rank districts < Private in Medium < Govn Aided in low < Govn aided in Medium**

This reinforces the above finding of lack of proactive effort to carry out student monitoring in the absence of any legal or policy directive. Government aided schools, under limited purview of the government still perform better than the totally unregulated private category.

- External checks, such as number of inspections and meetings of the school management committee, both prevent the school authorities from shirking in their efforts and thus have a positive and significant impact on student monitoring activities.
- Higher and better qualified teachers are more sensitized towards the importance of regular monitoring on student learnings and performance, hence conducive to higher monitoring, given by their positive and significant impact.
- As per head development expenditure by the school rises, the school is able to divert more resources towards monitoring actions – validated by the positive and significant impact of the expenditure variable.

## 2. Index of Infrastructure

$$\text{infra\_idx}_i = \beta + \beta_1 D_2 * M_2 + \beta_2 D_2 * M_3 + \beta_3 D_3 * M_2 + \beta_4 D_3 * M_3 + \beta_5 \text{PerDevExp}_i + \beta_6 \text{SMC}_i + \epsilon_i$$

<i>Variable</i>	<i>Description</i>
<i>infra_idx</i>	The index for school infrastructure
<i>D<sub>2</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in medium ranked districts
<i>D<sub>2</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in medium ranked districts
<i>D<sub>3</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in low ranked districts
<i>D<sub>3</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in low ranked districts
<i>PerDevExp</i>	Per Capita Development Expenditure
<i>SMC</i>	Presence of school management committee

## Results

Variable	Coefficient	Standard Error	P > t
D <sub>2</sub> *M <sub>2</sub>	-.018175	.0080432	0.024*
D <sub>2</sub> *M <sub>3</sub>	.0292919	.0016736	0.000**
D <sub>3</sub> *M <sub>2</sub>	-.0442736	.0071423	0.000**
D <sub>3</sub> *M <sub>3</sub>	.0345715	.0015846	0.000**
PerDevExp	.0026752	.0008611	0.002**
SMC	-.0522554	.0012674	0.000**

\*\*Significant at 1% level of significance as  $p < 0.01$

\* Significant at 5% level of significance as  $p < 0.05$

- The base dummy category here again is Government schools in high ranked district. Both interaction terms for government aided schools have significant negative coefficients while for private schools have significant positive coefficients, this satisfies apriori expectations of how private schools mostly beat government schools in their provision of infrastructure facilities. Government schools continue to perform poorly in terms of the basic facilities which has been detrimental to not just enrolment but learning capabilities as well. The aided schools have the worst infrastructure out of the three types – this could indicate neglect of such schools, governed neither by the private management with deep pockets nor

getting handholding by the government. To summarise, the level of infrastructure can be shown as :

**Aided in low and medium rank districts < Government schools < Private in low and medium**

- As per head development expenditure by the school rises, the school is using the resources to provide basic physical infra facilities to the students – validated by the positive and significant impact of the expenditure variable.
- Existence of an SMC has a significant negative impact of infrastructure, implying low decision making ability in the SMC – either due to lack of coordination, inefficiency in decision making or lower focus towards school infra needs. This finding is in line with some of the earlier studies on SMCs. A 2017 study by Charu Sethi and Alka Muddgal study the role of SMC members in the implementation of the Right to Education Act, 2009 by way of a descriptive survey in the schools of Delhi. They highlight how most SMCs are unable to meet their intended objectives on account of their dormant functioning, irregularity and lack of awareness among the members.

3. Primary and Upper Primary Level Passing % of students

$$\text{pass\_perc}_i = \beta + \beta_1 \text{infra\_idx}_i + \beta_2 \text{monitor\_idx}_i + \beta_3 D_2 * M_2 + \beta_4 D_2 * M_3 + \beta_5 D_3 * M_2 + \beta_6 D_3 * M_3 + \beta_7 \text{SMC\_Meets}_i + \beta_8 \text{Inspections}_i + \beta_9 \text{Grad\_Teachers}_i + \beta_{10} \text{ProfQual\_Teachers}_i + \beta_{11} \text{PerDevExp}_i + \beta_{12} \text{Road\_approach} + \epsilon_i$$

<i>Variable</i>	<i>Description</i>
<i>pass_perc</i>	% students scoring more than passing marks
<i>infra_idx</i>	The index for school infrastructure
<i>monitor_idx</i>	The index for monitoring quality
<i>D<sub>2</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in medium ranked districts
<i>D<sub>2</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in medium ranked districts
<i>D<sub>3</sub>*M<sub>2</sub></i>	Interaction dummy representing Government aided schools in low ranked districts
<i>D<sub>3</sub>*M<sub>3</sub></i>	Interaction dummy representing Private schools in low ranked districts
<i>SMC_Meets</i>	Number of meetings by the School Management Committees in the year
<i>Inspections</i>	Number of Visits for Academic Inspections in the Year
<i>Grad_Teachers</i>	% of teachers who are graduate or above
<i>ProfQual_Teachers</i>	% of teachers with professional qualification
<i>PerDevExp</i>	Per Capita Development Expenditure
<i>Road_approach</i>	Whether school has proper road connectivity

## Results

For Primary level Results			
Variable	Coefficient	Robust Clustered Standard Error	P > t
infra_idx	.0004759	.055793	0.993
monitor_idx	.0648786	.0231704	0.007**
D <sub>2</sub> *M <sub>2</sub>	-.170679	.0754138	0.027*
D <sub>2</sub> *M <sub>3</sub>	-.0678388	.0594296	0.257
D <sub>3</sub> *M <sub>2</sub>	-.0952427	.0605419	0.120
D <sub>3</sub> *M <sub>3</sub>	-.0785939	.0534001	0.145
SMC_Meets	.0007566	.0002482	0.003**
Inspections	.0035196	.0005735	0.000**
Grad_Teachers	.0494295	.0336709	0.146
ProfQual_Teachers	.0673095	.0299206	0.027*
PerDevExp	.0774638	.0129292	0.000**
Road_approach	-.0604611	.0185646	0.002**

\*\*Significant at 1% level of significance as  $p < 0.01$

\* Significant at 5% level of significance as  $p < 0.05$

- The base dummy category, like before, is Government schools in high ranked district. Since 3 out of 4 dummies are insignificant, it shows that at the primary level results do not vary significantly by different management types. It is only observed that aided schools in medium rank districts show lower performance. An interesting finding here is how aided schools in medium ranked districts exhibit lower performance vis-à-vis aided schools in low rank districts. This could imply how relatively advanced districts are more dependent on private schools in comparison to aided schools. Backward district witness greater enrolments in aided schools, given their lower spending power, thus increasing the significance and hence the attention given to the aided school in low rank districts, compared with that medium ranked ones.
- Monitoring efforts significantly improve student performance while infrastructure has no impact.
- External checks, such as number of inspections and meetings of the school management committee, both improve student performance by ensuring proper instruction schedules and pedagogy and a regular evaluation.
- In line with apriori expectations, higher and better qualified teachers are usually better able to handle subjects and deliver lectures with greater clarity, hence driving better student results
- Higher development expenditures lead to improved student results – justifying increase in fund allocation towards school expenditure.
- Schools with proper road connectivity are also positively correlated with student performance – this validates the hypothesis that better connectivity would lower student and teacher absenteeism, ensure more number of instructional days and regularity in teaching sessions – all conducive to better student results.

<b>For Upper Primary Level Results</b>			
<b>Variable</b>	<b>Coefficient</b>	<b>Robust Clustered Standard Error</b>	<b>P &gt; t </b>
infra_idx	.0646151	.0140845	0.000**
monitor_idx	.0553393	.0079796	0.000**
D <sub>2</sub> *M <sub>2</sub>	-.3558581	.0893111	0.000**
D <sub>2</sub> *M <sub>3</sub>	-.0825795	.0208779	0.000**
D <sub>3</sub> *M <sub>2</sub>	-.4369643	.0678521	0.000**
D <sub>3</sub> *M <sub>3</sub>	-.0984979	.0229159	0.000**
SMC_Meets	.0003794	.0000745	0.000**
Inspections	.0004094	.0000719	0.000**
ProfQual_Teachers	1.05e-07	.0121209	1.000
PerDevExp	.013066	.0021462	0.000**
Road_approach	-.0590856	.0113416	0.000**

\*\*Significant at 1% level of significance as  $p < 0.01$

- Unlike in the case of primary level results, all interaction terms have significant negative coefficients, this shows that student performance in aided and private schools in medium and low districts is lower than that of students in government schools. A possible explanation for this could be the ‘No-detention policy’ of the government which obligates schools to promote children to the next grade. Government schools tend to follow this principle for students, most of whom belong to low income households, so that they are not held back, which may drive higher drop outs and lead to impaired learning.
- Among the included interaction categories, the student performance can be ranked as :

<b>Aided in low rank &lt; Aided in medium &lt; Private in low &lt; Private in Medium</b>
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Students in aided schools lag behind their counterparts in the private schools. This finding is similar to previous studies including results shown by the National achievement Survey.

- The remaining results from the regression of performance at upper primary level are similar to what we see at the primary level, reinforcing our earlier findings. However, it can be noticed here that at the upper primary level infrastructure has a significant impact on results while teachers’ professional qualification ceases to impact student performance. These results indicate that it in the lower classes, student performance is more highly dependent on teacher qualifications and is not really impacted by the amenities the school provides, since younger students mostly base their school experience from their interactions and learnings directly imparted by the teacher. However at the higher level, students are highly impacted by the physical environment provided in the school, including provision of computers and computer courses which may not be very relevant at the primary level. Thus, it can be concluded that in higher classes, investment in infrastructure facilities has considerable positive externalities and can help in improving student performance by impacting their perception, health and motivation levels besides improving their skill sets.

## **Conclusion**

This paper uses the large rich UDISE resource and leverages data analytics on Uttar Pradesh school level data to gain meaningful insights on factors affecting school performance. It brings in a fresh perspective on investigating schools by studying school performance on key components of the RTE Act that speak about the critical nature of regular and periodic supervision using the tools of School Management Committees, Continuous and Comprehensive Evaluations and Special Training Programs. This, along with the school infrastructure facilities, gives a holistic view of key inputs that determine student perception, health and learning capabilities. Both these measures have been recommended as major guiding principles on various international fora for educational institutions. The inclusion of covariates on teacher quality, school expenditure and road connectivity make the analysis a comprehensive view on school outcomes. The different district categories, based on ranking of ten major development aspects, act as important controls and prevent any bias in reading of the results. The major contribution of the paper has been the comparison across the 3 key management categories of public, private and aided schools.

The results show that government schools put in maximum amount of efforts for monitoring and supervision, followed by aided and then private schools. This suggests lack of initiative and proactive effort on the school's part in the absence of government mandate for monitoring. Since the monitoring measure is found to have a significant positive impact on student performance, both at the primary and upper primary levels, it becomes imperative for school managements to acknowledge the need for the same. Government can pitch in by designing model mechanisms to be followed by the private and aided schools and making behavioural interventions in the form of social media recognition of well performing schools that meet certain standards of monitoring across different types of managements (private, aided and public).

Similar to previous studies, the results reinforce the findings of public schools lagging behind in the provision of amenities and physical infrastructure. As observed from the analysis, as students move to higher classes, their experiences are more highly defined by the kind of facilities the school provides. With transformation in the nature of working patterns, global education landscape has been witnessing a shift towards more application based and digitally enabled learnings. The emergence of such evolved pedagogy creates requirements for institutions also to update themselves and adopt a fresh approach to developing conducive environments in the school premises. The facilitation of better physical infrastructure, including proper playing spaces, computers and essential services of water and power would create better spaces for children to learn and improve their efficiency.

Certain recent initiatives of the UP government, taking cognizance of the state of education, have been focussed on bringing improvements in learning outcomes. One such initiative launched in 2018 in partnership with Pratham is the Graded Learning Programme which aimed to regroup classroom students according to current skills and designing tailor made sessions to improve their foundational learnings. This small yet innovative intervention produced major improvements in student reading and mathematics skills.

More such pedagogical interventions following the principles of ‘*Teaching at the Right Level (TaRL)*’ are not just effective and economical but also an urgent need for the many government and aided schools in Uttar Pradesh. The rich body of evidence shows how investment in relevant infrastructure and supervision can bring these schools at par with the privately owned institutions. At a time when large number of households have experienced income degradation due to the pandemic, such improvements in these low cost schooling options can bring much needed relief and support present and future generations, empowering them to lead better lives. This study has reinforced the above argument, justifying investment in government and aided schools for improvements in infrastructure and monitoring.

#### *Scope for Further Research*

The present study has certain limitations – student performance has been analysed only using the passing rates data. A possible improvement could be integrating the present dataset with results from the National Achievement Survey which explores student learnings to a much greater extent, going beyond their test scores. The study can also be replicated for a region wise analysis in Uttar Pradesh, and further extending it to other parts of the country for a cross country comparison. Owing to data limitations, these aspects remain outside the scope of the current paper.

## **References**

1. UDISE+ . 2019-20. <https://udiseplus.gov.in/#/page/publications>.
2. UNESCO. 2014. - <https://en.unesco.org/gem-report/report/2014/teaching-and-learning-achieving-quality-all>.
3. UNESCO Global Education Report. 2017. <https://en.unesco.org/gem-report/report/2017/accountability-education>.
4. Visscher, Adrie J. “Public School Performance Indicators : Problems and Recommendations.” *Studies in International Evaluation* 27(3), 2001.
5. Dixon, P., & Tooley, J. (2005). The regulation of private schools serving low-income families in Andhra Pradesh, India. *The Review of Austrian Economics*, 18(1), 29-54.
6. Barrett, Peter; Treves, Alberto; Shmis, Tigran; Ambasz, Diego; Ustinova, Maria. 2019. *The Impact of School Infrastructure on Learning : A Synthesis of the Evidence*. *International Development in Focus*. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/30920> License: CC BY 3.0 IGO

7. Timilsina, G. R., Sahoo, P., & Dash, R. K. (2022). Why Do Indian States Differ in Their Infrastructure Development?. *Development Research*.
8. Singh, R., & Sarkar, S. (2015). Does teaching quality matter? Students learning outcome related to teaching quality in public and private primary schools in India. *International Journal of Educational Development*, 41, 153-163.
9. Muralidharan, K., & Sundararaman, V. (2013). Contract teachers: Experimental evidence from India (No. w19440). National Bureau of Economic Research.
10. Konica Sehgal, 2022 – Evaluating the impact of quality of instructions and teacher beliefs & attitudes on student outcomes – thesis submitted to South Asian University
11. Chaudhury, N., Hammer, J., Kremer, M., Muralidharan, K., & Rogers, F. H. (2006). Missing in action: teacher and health worker absence in developing countries. *Journal of Economic perspectives*, 20(1), 91-116.
12. Glewwe, P., & Kremer, M. (2006). Schools, teachers, and education outcomes in developing countries. *Handbook of the Economics of Education*, 2, 945-1017.
13. Kishan, S. (2021). A Comparative Study in Public and Private Education Sector. Available at SSRN 3899066.
14. Sarthak Agrawal (2019) - Private school effects on public school teachers: Evidence from rural India, University of Oxford
15. Atuahene, S., Yusheng, K., Bentum-Micah, G., & Owusu-Ansah, P. (2019). The assessment of the performance of public basic schools and private basic schools, Ghana.
16. Gouda, J., Das, K. C., Goli, S., & Pou, L. M. A. (2013). Government versus private primary schools in India: An assessment of physical infrastructure, schooling costs and performance. *International Journal of Sociology and Social Policy*.