

Determinants of School Enrolment in Uttarakhand: Evidence from District-Level Regression Analysis

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ABSTRACT

The purpose of the research is to capture which factors, and to what level, influence educational outcomes in the Uttarakhand state. To understand the landscape, enrolment was assumed to be the outcome, and the paper starts by analysing the enrolment trend between 2013-2022 using data from UDISE+, where it observes a shift in the trend in the post-pandemic era with respect to enrolment between private and public schools. To understand the management dynamics (private-public) and to understand the broader view of the context affecting enrolment, in accordance with the data available, literature reviewed, and the framework set from Amartya Sen's capability approach, a regression analysis was performed. Geography, location, school availability, and management all stand significant in influencing enrolment, leaving infrastructure as insignificant. However, the role of management was further understood using literature, statistical analysis of infrastructure differences, and observations from the ASER survey 2022.

Keywords: Enrolment, Infrastructure, School choice

JEL Classification Codes: C21, I21, R11

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I. INTRODUCTION

Uttarakhand is a Himalayan state in northern India. Because of its geography, it has its unique impediments in moving towards development. In 2023, NITI Aayog reported that 35.9% of the population resides in urban areas (NITI Aayog), with a notable trend of migration toward the plains in search of better health, education, and employment opportunities. While only 14% of the state is plain in terms of geography (Uttarakhand Biodiversity Board), even then the three districts,



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Dehradun, Udham Singh Nagar, and Haridwar, have 51% of the population as their residence (Census, 2011).

In this background of the state, this paper delves into the status of education in the region. Education, particularly elementary education, stands as the base for achieving further goals such as increasing income, solving poverty and raising the standard of living, developing human capital to prepare people for creating innovation and increasing growth of the nation, and to a much broader purpose of creating a society with more intelligent, collaborative and ethical people.

To give a gist of the status of education, the elementary schools in Uttarakhand have achieved a gross enrolment ratio (GER) beyond 100, close to 113 (UDISE, 2022); but the learning outcomes, as reported by NAS (2021) and ASER (2022), are still at very low levels, raising concerns about quality. One way to address the concern from the developmentist perspective is to examine if the process of achieving gross enrolment has perpetuated any kind of divide in the economy. These divides can be seen through the differences in resources across different clusters and strata. The presence of differences can explain the quality concern, and prompts us to ask whether the efforts made towards achieving gross enrolment necessarily have anything to do with improving quality or reducing differences in education standards, or were solely to achieve the numbers to show off something.

So, in the light of existing literature, data, and the COVID-19 pandemic, this paper takes a data analytics approach to understand the status of elementary education. Broadly, the paper discusses three educational outcomes, particularly enrolment in schools, infrastructure, and learning outcomes, drawing understanding by analysing variations across regions, location, geography, management type, and time.

Furthermore, the paper uses support from the literature to make sense of the variations and then act accordingly.

Theoretical Framework

This theoretical framework is developed from multiple seminal works that underlines the importance of education and impediments to achieving good education.

Marshall (1890) considers expenditure done on education as a “strategic investment” with widespread effects, notably through the “creation of opportunities for the masses”. He states, “the economic value of one great industrial genius is sufficient to cover the expenses of the education of a whole town (Marshall, 1890).” Marshall emphasizes on the importance of skills, knowledge and health for growth of a nation. Adding to the argument, Becker (1962) and Schultz (1961), in their work on “Human Capital Theory”, demonstrates a positive relationship between education and income. Similarly, Lucas (1988) explicitly links education to economic growth in the long run, showing that investments in human capital can drive national productivity and development.

Heckman was interested in knowing the returns associated particularly with the childhood education. His research finds that the highest return on human capital investment occurs in the initial years of life; returns are especially high before a child enters formal elementary schooling, and then decline sharply as the child grows older (Heckman 2006, 2007). Therefore, he refers to children at the elementary level as “disadvantaged children,” emphasizing the need for early intervention.

Another seminal work relevant to this study is by Amartya Sen, who challenges the assumption of rational self-interest. Sen argues that people do not always act to maximize their own utility; they may act based on ethical concerns, social norms, or empathy-behaviors he critiques as inconsistent with purely self-interested models, which he terms the “rational fool” (Sen, 1977). Moreover, Sen (1985, 1999) in “Capability Approach theory” argues that every individual is primarily different in the sense that their current ability to convert inputs into outputs are very different; meaning two individuals with same input or resources will not transform that resources into same output or functionings they are aiming for; and the reason for this difference is found in their personal characteristics, environmental conditions, and social arrangements. This framework emphasize as to why elementary education is important, why contextual variables are important in influencing enrolment or children entering the formal years of education, why we often raise concerns about the quality in education, and how crucial it is to study education from the economic perspective. Furthermore, this framework can also explain parent preferences while choosing private or public education, as preferences are shaped by none other than contextual factors.

Enrolment Determinants

In many developing areas, whether a child goes to school often depends on how close the school is to their home. Ghosh (2018) and Namukwaya and Kibirige (2014) both note that distance matters as schools located near residential areas see higher enrolment. But apart from how far a school is, its physical condition also affects whether parents send their children to schools (Hanushek et al. 2004). Kipruto (2022) also adds that facilities such as clean toilets, safe drinking water, and a tidy environment make parents more comfortable sending children regularly. Perceptions also influence choices. Ekaette et al. (2023) found that large schools often seem more reliable to parents because they assume such schools have more teachers, better resources, and a stronger reputation. Still, just getting students into school isn't enough, keeping them there depends on how good the education is. Namukwaya and Kibirige (2014) mention that a dull curriculum or unmotivated teachers often make children drop out.

When children fail to see the relevance of what they are taught, or when they encounter unconcerned teaching, the likelihood of dropping out increases. This in turn affects overall enrolment, as communities begin to lose faith in the value of schooling.

Similarly, data from NSSO household surveys show that poor quality of education is mentioned just as often as poverty as a reason why children never enrol in school, and it is given even more importance when explaining why students drop out (Ghosh, 2018).



According to Mallick (2014), teacher shortages, lack of school monitoring, and corporal punishment are reasons why people do not enrol their children in schools. These issues within schools are captured more clearly in studies related to the reasons for students dropping out. These studies highlight problems related to accessibility, and quality in schools (Lewin, 2007; Kiran Bhatta et al., 2016; R. Govinda, 2008; Goswami, 2009; Stuart Cameron, 2008).

The factors that we just discussed are supply-side factors, as they are influenced by the actions and conditions within the school itself. However, there are also issues that are not directly perpetuated by schools, these are known as demand-side issues.

Although it is not entirely clear which side (demand or supply) has a greater impact, a weakening relationship between supply-side interventions and enrolment, alongside the growing influence of demand-side issues, may leave policymakers with fewer levers to pull. In such a scenario, actions like opening new schools or increasing the budget for infrastructure may become less effective (Handa, 2002).

While further research is needed to determine which side is more influential, we may conclude this discussion by citing the observation made by Heyneman and Loxley (1983), who found that nations who are in the developing stage, their school-related factors tend to have a greater influence on enrolment and achievement than household-related factors. However, as countries increasingly focus on educational quality and move toward greater privatisation, these school effects are likely to diminish (Baker, 2003).

Now, we turn to determinants that lie outside the control of schools. One of the most prominent issues stems from household characteristics. Poverty and financial constraints have been widely identified as significant factors influencing enrolment decisions (Kipruto, 2022; Ghosh, 2018; Namukwaya & Kibirige, 2014; Sikdar & Mukherjee, 2012; Moses, 2021; Mallick, 2014).

Moreover, Ghosh (2018) observing the NSSO data pointed that the families having more children often exclude children from education. Poverty also contributes to poor health and inadequate nutritional intake among children, which has been cited as another reason for non-enrolment or increased risk of dropping out and it can also hinder the brain development invariably affecting the child's growth and participation (Govinda & Bandyopadhyay, 2008).

Parental education or literacy (Mallick, 2014), particularly the level of education attained by the head of the family (Baluch & Shahid, 2002) and the mother's education (Moses, 2021), has been found to play an important role in determining enrolment in schools.

In addition, cultural practices and traditions accepted within households, and shared across communities, also influence enrolment decisions (Sikdar & Mukherjee, 2012). These include practices such as child labour, early marriage, and lifestyle choices (Namukwaya & Kibirige, 2014). Mallick (2014) further argues

that child labour represents a particularly high opportunity cost for families, discouraging school attendance.

Furthermore, the type of region also influences school enrolment (Ghosh, 2018). The areas with peculiar geography like in drought prone areas, food security is a major concern and those times forces parents to keep children home instead sending them to school (Namukwaya & Kibirige, 2014).

Beyond regional or geographical division there exists location-based division. The location that are more advance in economics, infrastructure or social aspects are considered to be urban and this is why schools situated in urban areas records higher enrolment generally than those in situated in rural locations (Moses, 2021). This is largely because urban locations offer better infrastructure, easier access, and a much stronger public perception of educational quality (Ekaette et al., 2023). Falling fertility rates could be one direct reason for the decline in school enrolment (Retnakumar and Arokiasamy, 2003). However, falling enrolment means fewer children in each class, so whatever the reason may be, it also helps improve the student-teacher ratio, which directly improves one-to-one learning time between students and teachers.

The barriers to enrolment with respect to the girl child are often different. Early marriage remains one of the key reasons girls drop out of school before completing their education (Mallick, 2014). Household chores and unpaid domestic work limit their time for schooling (ILO, 2021; Sikdar & Mukherjee, 2012). Household work thus becomes the opportunity cost of going to school, which often rises during periods of economic stress, as families need more workers and try to cut down on expenditure, thereby prioritizing boys' education (Ekaette et al., 2023; ILO, 2021). Therefore, any other shock, such as climate change, worsens the situation further by increasing the workload for girls both at home and in agricultural tasks, leaving them with even less opportunity to study (ILO, 2021).

Enrolment Trends in Uttarakhand

Figure-1 below shows that the enrolment of the private schools have been increasing in the last decade while the government schools managed by Department of education shows a declining trend in the last decade. However, in the post-COVID years we do see a trend reversal, as private schools observes a fall in the enrolment while government schools observe a rise in the enrolment. This suggests two things. Firstly, there exists an inclination for private schools, and secondly, the COVID shock did something which reverses the trend.

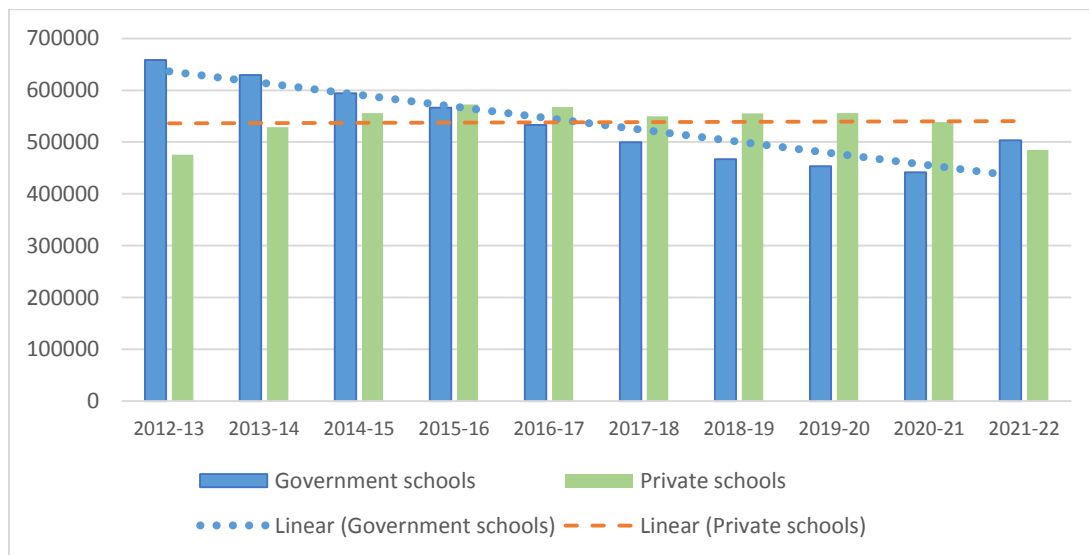
In the Figure-2 we observe a another important insight about the private schools, that even though the preference for the private schools are clear with increasing enrolment every year but this addition is not adding with an increasing rate, which means private schools are not expanding rapidly but are just able to maintain their increasing trend, while government schools also showed a stable decreasing trend, means that the percentage decrease in the government schools is stable until the post-COVID year.

Talking particularly about the post-COVID period in 2020-21, both private and government schools witnessed a decline in enrolment (Figure-1), while in 2021-22 the trend reverses and the enrolment of government schools rises while the



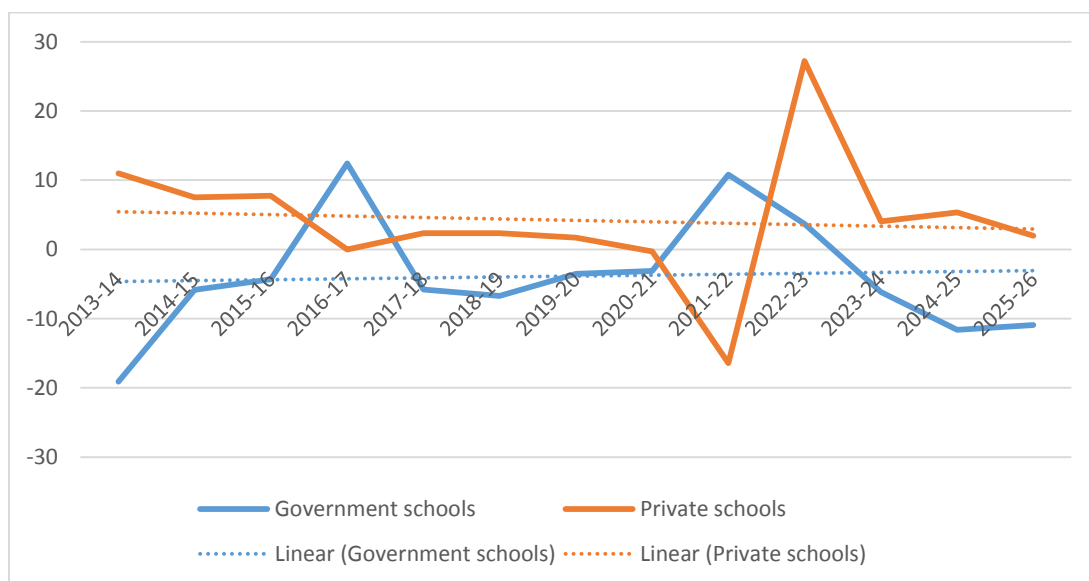
enrolment in private schools was still on the decline. However, this trend again reverses in the post-COVID periods, and government school again faced fall in enrolment while private schools face increase in enrolment again. So, the trend line is positive for the private schools showing that enrolment is always increasing on an average for private schools, while the trend line is always been below zero for the government schools showing enrolment on an average is always decreasing.

Figure-1: Trends in Enrolment by School Management in Uttarakhand



Source: Compiled by authors based on UDISE+

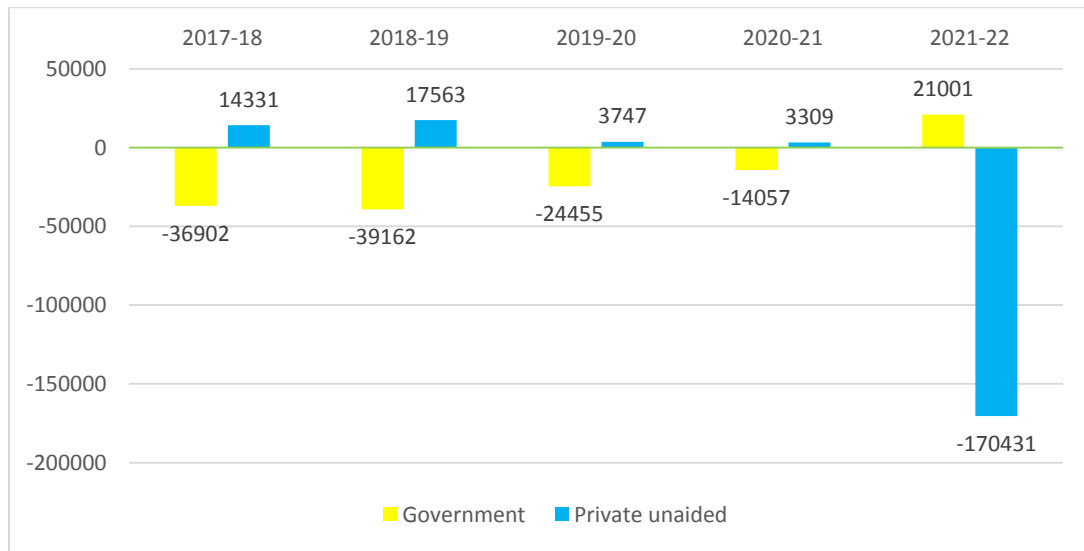
Figure-2: Trends in Enrolment Growth by School Management in Uttarakhand



Source: Compiled by authors based on UDISE+

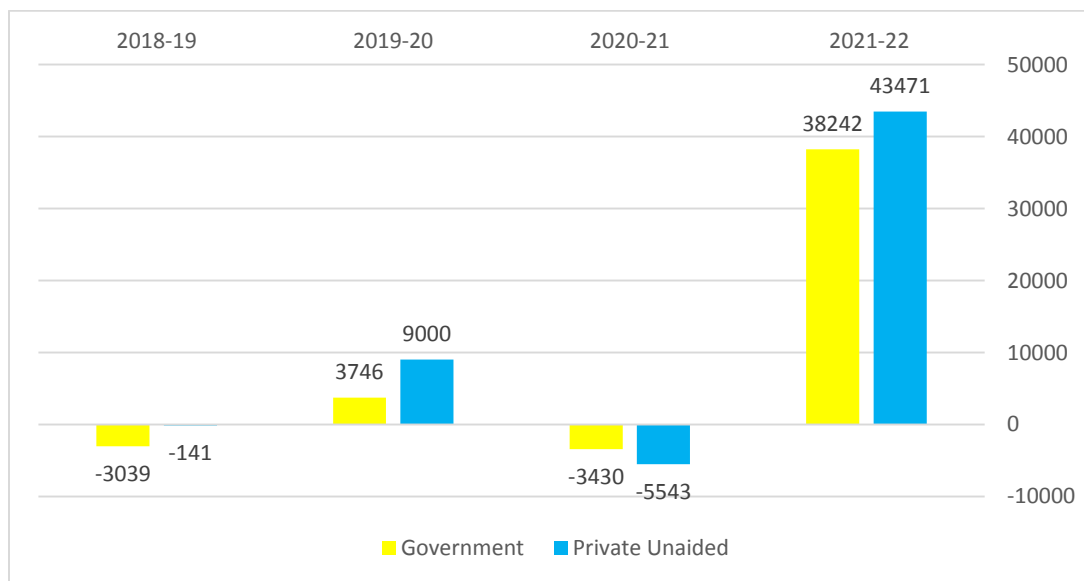
Now, in order to address the question of why and how private schools have witnessed such a decline in enrolment in the post-COVID years, we further disaggregated the data by urban and rural areas. This breakdown allows us to unveil the spatial dynamics. The following graphs present enrolment patterns in private and public schools, separated by urban and rural contexts.

Figure-3: Annual Change in Student Enrolment by Management & Location (Rural, Uttarakhand)



Source: Compiled by authors based on UDISE+

Figure-4: Annual Change in Student Enrolment by Management & Location (Urban, Uttarakhand)



Source: Compiled by authors based on UDISE+

From Figure-3 we can observe that rural Uttarakhand saw a large shift from private unaided schools to government schools in enrolment from 2020-21 to 2021-22, with a dramatic drop in private school enrolment by 170431 in 2021-22 and positive increase in enrolment in government schools by 21001 in 2021-22. While Figure-4 concerning urban Uttarakhand showed recovery and growth, as in both government and private unaided schools enrolment rose by 38242 and 43471 respectively in 2021-22, with private unaided schools having a slightly higher gain in enrolment than government schools. This was observed after a dip in 2020-21 by 3430 and 5543 by government and private schools respectively. From the rural-urban location perspective we can see that private schools have performed marginally better than the government schools in urban areas while in rural areas government schools outperformed private schools during the COVID.

There could be many reasons for such backlash particularly in the rural area. Affordability remains a significant concern in rural areas, where families are more likely to switch to government schools to ensure the continued education of their children (Bordoloi & Ranjan, 2021). This highlights why poverty emerges as one of the strongest contributing factors in several studies discussed earlier (Kipruto, 2022; Ghosh, 2018; Namukwaya & Kibirige, 2014; Sikdar & Mukherjee, 2012; Moses, 2021; Mallick, 2014). As observed, the vast majority of private schools charge low fees, especially when compared to the average daily and monthly earnings of people in the state (Gandhi, 2017). These low-cost private schools often struggled to generate sufficient revenue during the COVID-19 pandemic, as fee collection was disrupted while operational costs such as rent, utilities, and loan repayments persisted, leading to the closure of many such schools, including in India, where in the rural areas approximately 35% of students were enrolled in private schools (Alam et al., 2021). Hence, we can say rural areas majorly dominated by the poor and the marginalised often have government schools as the only viable option to choose (Bordoloi & Ranjan, 2021; Harma, 2010). Harma thus argues against the marketisation of education, which tends to fail in such contexts.

While the whole country was in serious financial crises during the COVID it had a disproportionate effect on the most vulnerable groups such as low-skilled and female workers (ILO, 2022). So particularly people in the rural areas could not afford mediums such as smartphones, televisions, internet to provide any kind of education to their child during the time and this distraction from education was even greater for the sscheduled caste, scheduled tribe, girls, and economically disadvantaged households (Bordoloi & Ranjan, 2021).

While the performance of the private sector varies widely, studies suggest that low-fee private schools often perform similarly to government schools in terms of learning outcomes (Shivakumar & Rustagi, 2010). These low-fee private schools, however, suffered significant financial losses during the pandemic, which resulted in widespread fee defaults, school closures, and unpaid teachers (Alam & Tiwari, 2021). The above-mentioned literatures all adds up to found reasoning behind the fall in enrolment in private schools while there were also closures in the government schools as UDISE data indicate that approximately 387 elementary schools were closed between 2021 and 2022, of which 254 were government schools.

Both private and government schools faced challenges during the COVID-19. WhatsApp was the primary mode of instruction in 75% of both types of schools, followed by phone calls between teachers and students in 38% of cases (Vyas, 2020). Moreover, 75% of parents reported difficulties with WhatsApp-based lessons while limited access to smartphones, lack of internet connectivity, and poor signal quality were identified as major obstacles to educating their children during school closures (UNICEF & UNESCO, 2021; Vyas, 2020). As a result, both private and government schools struggled equally to deliver effective remote learning, particularly in rural areas.

This analysis of COVID informs us more about private schools, particularly their non-sustainability to the COVID shock, as they were running at low fees. Then the question arises: why are private schools preferred, or what kind of quality in education are they providing? We have discussed these questions in another section on school choice.

Hence, we could sum up three reasons for the decline of enrolment during COVID:

- Continuous closure of government schools following the trend
- Closures of private schools, low-fee to be exact, that were unable to sustain themselves in the shock of the financial crisis
- Poverty and the presence of vulnerable groups in the country as a supply-side issue

However, it brings up debate on:

- The quality of education among private schools and its differences from government-owned schools
- Dependence on marketisation of education

II. METHODOLOGY

Data Source and Description

The data were extracted from the Unified District Information System for Education (UDISE) for the years 2012–13, 2015–16, 2018–19, and 2021–22. The dataset covers all 13 districts of Uttarakhand, forming a balanced panel of 208 observations (13 districts × 4 time periods). The variables include school enrolment, number of schools, and detailed data on school infrastructure. Furthermore, management type (public vs. private), location (rural vs. urban), and geography (hilly vs. non-hilly) were included as dummy variables in the regression analysis. Infrastructure indicators were grouped into two composite indices:

- Basic Infrastructure, which includes access to electricity, drinking water, functional toilets, and boundary walls.
- Didactic Infrastructure, which covers libraries, laboratories, computers, and other learning-related facilities.

A total of 14 infrastructure sub-indicators were used to construct these indices.



Variable Construction and Justification

Influence of Demographic and Institutional Factors on Enrolment

Our literature review justifies the importance of school accessibility, management type, location, and geographical differences and infrastructure in influencing the enrolments. These dimensions capture how differences in access, availability of facilities, and institutional support can affect the school enrolment or participation of children in schools.

Capability Approach Perspective

“Capability approach” conceptualised by Amartya Sen shows us how contextual differences are able to influence outcomes by affecting the ability of the child to convert available resources into valuable educational functionings.

Contextual Significance for Uttarakhand

While enrolment in schools in Uttarakhand has significantly improved over the years with government schools providing access, we also observe a preference for private schools. Moreover, an overall challenge of decent learning outcomes still seems to be a distant goal. Therefore, understanding Uttarakhand from its geographical peculiarities and types of administrative control remains an important aspect for consideration, because as soon as the accessibility objective is reached, the quality aspects begin to show their impact on each type of outcome, including enrolment.

Research Questions

- (i) How much are the geography, location, management, and availability of schools able to affect enrolment?
- (ii) Does school infrastructure significantly affect enrolment in Uttarakhand?
- (iii) Are there significant differences in infrastructure between private and public schools?

Hypotheses

From these research questions, we formulate the following null hypotheses (H_0):

- H_{01} : Hilly terrain, management type, and rural-urban location do not have a significant influence on school enrolment.
- H_{02} : School infrastructure has no significant effect on enrolment.
- H_{03} : There is no significant difference in infrastructure between private and public schools.

The alternative hypotheses (H_1) will be the opposite of the null, stating that there is an influence, effect, or difference, respectively.

Statistical Techniques Used

To examine the first two hypotheses regarding the effect of hilly terrain, privatisation, rural–urban location, and infrastructure on enrolment, regression analysis is applied. To test the third hypothesis regarding differences in infrastructure between private and public schools, a Chi-square test is conducted, and the results are graphically presented for better interpretation.

Model Specification and Variables

To estimate the influence of the factors on enrolment a model a multiple linear regression model was estimated using R software. The models explore how number of schools, infrastructure, school management, geography, and temporal trends influence enrolment levels.

The dependent variable is a log-transformed measure of school enrolment, which helps stabilize variance and address skewness.

The model includes both continuous and categorical independent variables. $\log_Basic_Infra$ captures the logarithmic transformation of basic infrastructure facilities such as electricity, toilets, and drinking water. $z_Didactic_Infra$ is a standardized z-score of didactic infrastructure (e.g., libraries, labs, computers). $Schools_log$ reflects the log of the number of schools available in a district.

Additionally, three categorical variables are included:

- Management (reference category: Private)
- Location (reference category: Rural)
- Geography (reference category: Hilly)

A categorical Year variable is also included to account for time-fixed effects, with the year 2012–13 used as the reference category.

The model is specified as follows:

$$Enrollment_{it}^* = \beta_0 + \beta_1 \cdot \log(BasicInfra_{it}) + \beta_2 \cdot z(DidacticInfra_{it}) + \beta_3 \cdot \log(Schools_{it}) + \beta_4 \cdot Management_i + \beta_5 \cdot Location_i + \beta_6 \cdot Geography_i + \beta_7 \cdot Year_t + \varepsilon_{it}$$

Where,

- $Enrollment_{it}^*$: The latent or observed level of student enrolment in unit (e.g., school/district) i at time t . It captures the total number of students enrolled in educational institutions, which may reflect the combined influence of infrastructure, location, governance, and other contextual factors
- $\log(BasicInfra_{it})$: Natural logarithm of the basic infrastructure index (e.g., availability of toilets, electricity, drinking water)
- $z(DidacticInfra_{it})$: Standardized score (z-score) of didactic infrastructure (e.g., library, lab, blackboard, books)
- $\log(Schools_{it})$: Natural logarithm of the number of schools in district/region/school i at time t



- $Management_i$: Categorical variable for school management type (e.g., public = 0, private = 1)
- $Location_i$: Dummy variable indicating school location (e.g., urban = 0, rural = 1)
- $Geography_i$: Dummy variable for terrain type (e.g., plain = 0, hilly = 1)
- $Year_t$: Year fixed effects to control for time-specific influences
- ε_{it} : Error term capturing unobserved factors affecting enrolment

III. ANALYSIS AND FINDINGS

Model Diagnostics

We ran classical linear regression model but to expect the best results we need to diagnose the data fulfilling the assumptions of the CLRM. The data found out to be non-normally distributed, as indicated by the Shapiro–Wilk test, and exhibited heteroscedasticity, confirmed through the Breusch–Pagan test. To address these issues, the dependent variable (Enrolment) was log-transformed, which improved the normality of residuals and resolved heteroscedasticity. Linearity was tested using the Box-Tidwell test which indicated that Schools was non-linearly related to the dependent variable. This school variable was therefore also log-transformed, which corrected the issue and improved model fit. To assess multicollinearity, Variance Inflation Factors (VIFs) were examined and found to be within acceptable limits (all below 5). Autocorrelation was tested using the Durbin–Watson statistic. Skewness was assessed visually for the infrastructure variables. As a corrective measure, Basic_Infra was log-transformed, and Didactic_Infra was converted into a z-score, reducing scale effects and ensuring comparability. These diagnostic procedures and transformations helped ensure that the final regression model met the key assumptions of linearity, normality, homoscedasticity, and independence.

Interpretation of the Regression Coefficients

Table-1 shows the regression results. The dependent variable used is log-transformed enrolment, and all interpretations reflect proportional effects. When the dependent variable is written in logarithmic form, the coefficients (β) are interpreted as percentage-based effects rather than absolute changes. For continuous variables, a one-unit change in the predictor leads to a percentage change in enrolment, after controlling for other factors. For dummy variables, β shows the relative difference between the group and its reference category. To convert that into a clear percentage effect, the following expression is used:

$$(e^{\beta} - 1) \times 100$$

This step brings the result back from the log scale to the real-world scale, making it easier to understand how much enrolment increases or decreases, on average, when the variable changes, with all other variables held constant.

School Management

Public schools are associated with significantly lower enrolment than private schools, even after controlling for infrastructure, geography, location, and year. The coefficient estimate (−1.02) suggests that, on average, public schools enrol

approximately 64% fewer students than comparable private schools. Indicating, if a private school enrolls 1,000 students, a similar public school would be expected to enrol only around 360 students, all else being equal.

Location (Urban vs. Rural)

Urban schools have higher enrolment levels than rural ones. The positive and significant coefficient for Location: Urban indicates that urban schools enrol about 33% more students than rural schools. For instance, a rural school enrolling 1000 students would be expected to enrol approximately 1330 students if it were located in an urban area.

Geography (Non-Hilly vs. Hilly)

Schools located in non-hilly districts see substantially higher enrolment than those in hilly regions. The coefficient implies that enrolment in non-hilly areas is more than 2.4 times higher (approx. 139% higher) compared to hilly areas, suggesting geographical accessibility plays a critical role in student participation.

Year Effects (Time Trend)

Compared to the base year 2012–13, enrolment in 2021–22 shows a significant decline of approximately 24.2%, likely reflecting the impact that the COVID-19 made on school enrolment. This means that if average enrolment in 2012–13 was 1000 students, it would have dropped to approximately 758 students by 2021–22, holding all else constant.

Availability of Schools

The number of schools in a district is strongly and positively associated with enrolment. The elasticity coefficient (approx. 0.90) implies that a 10% rise in the number of schools is related with a 9% increase in enrolment, all other factors held constant.

Table-1: Results of CLRM

Variable	Coefficient	Std. Error	Significance
(Intercept)	3.113	-1.672	.
log(Basic Infrastructure)	0.488	-0.406	
z(Didactic Infrastructure)	0.074	-0.063	
log(Number of Schools)	0.901	-0.031	***
Management: Public	-1.020	-0.102	***
Location: Urban	0.288	-0.102	**
Geography: Non-Hilly	0.872	-0.081	***
Year: 2015–16	-0.060	-0.087	
Year: 2018–19	0.14	-0.102	
Year: 2021–22	-0.277	-0.119	*

Source: Compiled by authors based on UDISE+

Note: Significance levels are denoted as

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; . $p < 0.1$; no symbol indicates $p \geq 0.1$



School Choice: Private vs. Public

As our regression suggests, there are greater chances of increasing enrolment through private schools than through public schools.

Several studies have traced parental perceptions to understand why parents prefer private over public schools. These preferences are not necessarily based on objective definitions of “quality,” but rather on perceived school status, peer composition, and insider knowledge.

According to Saltmarsh (2024) parents’ preferences are often shaped by social cues and perceptions. Therefore, factors such as peer environment, reputation, and word-of-mouth networks all play a significant role. Cantu et al. (2021) and Hofflinger (2019) find that school safety is a top priority for nearly all parents. Cantu et al. (2021) also identify cleanliness, well-maintained infrastructure, the physical appearance of the school building, and how students and parents are treated as major determinants of school choice. Hofflinger further observes that the chances of enrolling a child increase if the school has been successful in enrolling a sibling of the family. Ghosh and Dey (2020) observe that high-income and well-educated parents are more inclined towards private schools.

Mousumi and Kusakabe (2017) point to an interesting analysis that parents’ experiences with private schools are not very satisfactory, as they raise concerns about quality, often citing untrained teachers, high tuition fees, and other hidden costs as problems. But they still perceive private schools as better than government schools (Mousumi and Kusakabe, 2017; Lahoti and Mukhopadhyay, 2019). Lahoti and Mukhopadhyay (2019), in their rural study, found that private schools attract parents by making a modern school image, branding themselves as English-medium schools, following a mandatory English-speaking policy, mandatory uniforms, fixing CCTVs on the premises, and organizing activities as part of that image. However, the reality is that even their teachers struggle to speak in English, and many schools conduct classes in local languages, promoting visible discipline through uniforms and prayer assemblies, which often align with concepts like “sanskhaar,” which parents carry as a belief of the institution being good. Parents associate “good behavior” and “ambition” with private schools, and not with public schools (Auðardóttir and Kosunen, 2020). These differences in perceptions have led parents to prefer low-fee private schools.

Lahoti and Mukhopadhyay (2019) pointed out the lack of information exists between parent and school regulators, there exists a difference in what educational practices are marketed and what actually the school is implementing. The emphasis on discipline in private schools acts as a proxy for better quality, though it doesn’t necessarily correspond to better teaching or learning outcomes. Ghosh and Dey (2020) also note that there exists no significant evidence on private schools being better than the public schools when academics is the major concern. However, (Mousumi and Kusakabe, 2017; Lahoti and Mukhopadhyay, 2019; Auðardóttir and Kosunen, 2020) argue that many parents face a dilemma while making school choices between private and public schools, trying to acknowledge their strengths and weaknesses on the one hand and being influenced by the perceptions, financial levels, and expectations framed from cultural identities on the other.

Hence, we further move towards outcome-based studies comparing private and public schools' educational outcomes to gain a better understanding of their differences.

Table-2 presents data from ASER 2022 comparing basic reading and arithmetic skills among children enrolled in government and private schools in rural Uttarakhand.

Looking at ASER data, we found that private schools are clearly outperforming the public schools in basic learning outcomes. For instance, 57% of children in private schools in Grade V could read a standard Grade II-level text, compared to just 39% in government schools. Similar trends were observed across other indicators as well; such as arithmetic skills, where private school students consistently show higher proficiency in subtraction and division. These figures produce more causal understanding of for our regression results of why private schools tend to have more enrolments.

However, being better does not make them right. And before jumping to any conclusions, we still have to consider and think about other factors as well. First, not all the differences between the two types of schools are accrued to better outcomes but are the result of factors discussed in the studies mentioned above (Mousumi and Kusakabe, 2017; Lahoti and Mukhopadhyay, 2019; Auðardóttir and Kosunen, 2020). Secondly, while private schools demonstrate relatively better performance, the absolute levels of achievement are worryingly low across both sectors. In multiple indicators mentioned in the ASER 2022 data, private schools were not able to make even 50% of the children competent in basic capabilities. Thirdly, many studies have pointed out that private schools often attract children from wealthier families, which leads to separation between social classes in the education system (Auðardóttir & Kosunen, 2020; Bhatta, 2020; Edwards and Anderson, 2025), thus unintentionally causing segregation in society. As a result, school choice, instead of bringing diversity, often increases division among students.

Table-2: Year 2022 Rural Uttarakhand Reading and Academic Skills of Enrolled Students

	Public schools	Private schools
% of student in grade 3rd who can read grade 2nd level text	22	37
% of student in grade 5th who can read grade 2nd level text	48	63
% of student in grade 8th who can read grade 2nd level text	81	85
% of student in grade 3rd who can do at least subtraction	15	39
% of student in grade 5th who can do division	24	42
% of student in grade 8th who can do division	40	54

Source: Compiled by authors based on ASER 2022

Infrastructure

The variable infrastructure in our regression analysis was not statistically significant although the coefficient of both basic and didactic infrastructure was positive. Their direction suggests a possible relationship with enrolment. This may suggest that infrastructure can play an indirect or contextual role, and its effect



could become more pronounced in interaction with other variables such as school quality or teacher availability. Further research may be needed to unpack this relationship.

In a study of systematic literature review done by Cuesta et al. (2016) they suggested that mere availability of infrastructure can have significant effects on learning outcomes. They divided infrastructure different aspects: basic infrastructure such as toilets, potable water, electricity, and sanitation is associated with improved student attendance; physical space variables like classroom size, pupil-teacher ratio, and number of classrooms influence test scores; structural quality (including safety, ventilation, roofing, lighting, and cleanliness) is linked to higher teacher attendance and motivation; instructional facilities like libraries, science labs, ICT rooms, blackboards, desks, and learning aids contribute to improved cognitive outcomes; and finally, digital and communication infrastructure—such as internet access, computers, smart boards, and audiovisual tools, holds promise but its effectiveness depends heavily on teacher training and readiness. Similarly, Earthman (2002) synthesized findings from empirical studies concluded that lighting, thermal comfort, noise control, and building maintenance significantly affect student academic performance, especially for disadvantaged students. Maxwell (2018) went ahead and argues that the school's physical environment is not neutral; it can enhance or hinder learning by shaping students' perceptions, emotions, motivation, and social interactions.

Some other eminent researchers like Hanushek (1997), argue that putting more money does not necessarily make better schools although Hanushek et al. (2004) states that infrastructure may not be the primary factor in learning outcomes but it does have crucial role to be played in influencing school choice. Hanushek's meta-review of 377 education production function studies conducted between the 1960s and mid-1990s concluded that increasing spending on school resources—including teacher salaries and infrastructure—does not consistently enhance academic achievement when these resources are not used effectively. Dymont (2005) suggested effective ways: that infrastructure, particularly outdoor spaces and school grounds, can be powerful tools for interdisciplinary; hands-on learning when teachers are trained and supported to integrate them meaningfully into the curriculum. The physical environment, including non-classroom infrastructure, becomes a dynamic learning resource only when educators feel confident and prepared to use it.

Barrett et al. (2018) explains reasons for the differences in the impact of infrastructure on educational outcomes. In a World Bank-supported systematic literature review of 100 empirical studies they found that optimizing schools in terms of certain quality infrastructure features can lead to learning gains of up to 25%. These features include appropriate lighting, use of color, thermal comfort, air quality, noise control, classroom organization that promotes autonomy, and ergonomic furniture and equipment (Barrett et al., 2018).

Unfortunately, major educational monitoring systems like UDISE in India do not provide data of infrastructure on quality standards and it also lacks information on certain aspects as such as number of classrooms, teacher absenteeism, cleanliness, audio-visual tools, lighting, thermal comfort, noise control, and

building maintenance as mentioned in studies we just discussed (Cuesta et al. (2016); Earthman, 2002). Data often records only the availability, not the quality or maintenance of infrastructure.

Jha and Gaiha (2012) focusing on enrolment in rural areas, found that access to public infrastructure—such as roads, electricity, and drinking water; significantly improves enrolment, grade attainment, and years of schooling completed and they are especially important in reducing dropout rates among girls and lower-caste students.

Out of our analysis and similarly in the literature, we found that infrastructure has a positive relationship with enrolment (Nasuna et al. (2022), while Hanushek et al. (2004) consider infrastructure to be non-primary but acknowledge its role in influencing school choice. Some research talks about the quality (Barrett et al., 2018) of infrastructure and the effective use of infrastructure (Dyment, 2005) if it is to enhance educational outcomes. Maxwell (2018) focuses on infrastructure being a moderator that works indirectly by shaping an appropriate environment for learning.

Thus, we need to analyse the status and differences in infrastructure to understand whether there are differences between private and public schools, which can logically be rectified as a possible cause for private school choices in Uttarakhand. Hence, our literature supports exploring whether there exist differences in infrastructure between private and public schools in Uttarakhand, which will provide some rationale for why people are choosing private schools. Secondly, as we saw that enrolment in private rural schools performed poorly compared to private urban schools, a difference in infrastructure between private rural and private urban schools also seems to be a good consideration for analysis to explain the enrolment difference, as we highlighted in our own analysis.

To statistically examine this observation, we conducted a Chi-square test under the null hypothesis that there is no significant difference in infrastructure between rural public and rural private schools in Uttarakhand. This analysis helps bridge the theoretical understanding of parental school choice with the empirical patterns of infrastructure in the state. To examine whether the availability of infrastructure facilities is different in two types of schools (private and public) in rural areas, Chi-square test of independence (2*2) was used (Table-3). This technique was used as the data was available in two categories – facility available or not available.

Null: There is no significant association between school type (rural public/rural private) and the availability of the respective infrastructure facility (available/not available).

Table-3 informs us about two things, firstly, number of schools (in percentage) in which respective infrastructure facility is available, and secondly it reports the chi-square output for differences in the two types of schools as stated and discussed.

As in majority of the infrastructure availability the null hypothesis was rejected except for furniture facility. It means that availability of infrastructure in rural public schools is significantly different from the availability of infrastructure in rural private schools



And the percentage wise data of rural public and rural private in Table A reports the total percentage of schools having a particular facility which clearly shows that rural private schools in 8 out of 9 facilities is relatively better than rural public schools.

Table-3: Chi-square Test of Infrastructural Differences across Public and Private Schools on Rural Uttarakhand

	Rural Public (%)	Rural Private (%)	Chi-Squared	Df	P value	CI	Null
Electricity	83	91	115.05	1	< 0.001	99%	Reject
Playground	72	91	439.99	1	< 0.001	99%	Reject
Furniture	88	88	0.000625	1	0.9801	90%	Fail
Toilet	93	97	82.162	1	< 0.001	99%	Reject
Drinking facility	90	94	56.344	1	< 0.001	99%	Reject
Purifier	23	36	191.27	1	< 0.001	99%	Reject
Medical	47	33	157.64	1	< 0.001	99%	Reject
Internet	13	49	1781.8	1	< 0.001	99%	Reject
Computer	40	77	1181	1	< 0.001	99%	Reject

Source: Calculated by authors based on UDISE+

However, as Kingdon (2017) observed earlier that there are low fee private schools which seem to be losing grounds in enrolment and similar conclusion is also partially supported by our Figure-3 as private schools become vulnerable during the COVID. Therefore, we can also observe this emerging insight that whether the rural private school are different in infrastructure available from urban private schools?

Hence, we ran Chi square test (2*2) again to understand the scenario comparing rural private with urban private (Table-4).

Null: There is no significant association between school type (rural private/urban private) and the availability of the respective infrastructure facility (available/not available).

Table-4 suggests two things, firstly, there exists a significant difference between the availability of infrastructure between rural private and urban private and secondly in 8 out of 9 facilities urban private schools do better.

The findings of Tables 3 and 4 help explain the school choice patterns highlighted in the literature, where parents are often drawn toward private schools due to visible infrastructure differences (Lahoti & Mukhopadhyay, 2019). Furthermore, as Kingdon (2017) emphasized, many low-fee private schools exist, and they predominantly operate in rural areas. Our analysis which observes the difference in infrastructure between rural private and urban private schools confirms that rural private schools typically have lower levels of infrastructure comparative the urban private schools. This produces reason as to why private schools in rural were performing different from the urban counterparts in the post-COVID-19 scenario, they do differ in quality aspects and this is why they experienced greater enrolment losses than those in urban areas. Therefore, the presence of low-fee private schools

in rural schools becomes more evident. As due to lack of financial sustainability it will be difficult for such schools to have and sustain infrastructure as well.

Table-4: Chi-square Test of Infrastructural Differences across Public and Private Schools on Urban Uttarakhand

Indicator	Rural Private (%)	Urban Private (%)	Chi-Squared	Df	P value	CI	Null
Electricity	91	99	99.543	1	< 0.001	99%	Reject
Playground	91	89	3.7466	1	0.05291	91%	Reject
Furniture	88	96	69.552	1	< 0.001	99%	Reject
Toilet	97	99	21.288	1	< 0.001	99%	Reject
Drinking Water	94	98	24.586	1	< 0.001	99%	Reject
Purifier	36	56	153.51	1	< 0.001	99%	Reject
Medical care	33	29	6.6007	1	0.01019	95%	Reject
Internet	49	65	100.75	1	< 0.001	99%	Reject
Computer	77	90	108.08	1	< 0.001	99%	Reject

Source: Calculated by authors based on UDISE+

IV. CONCLUSION

This study set out to investigate the factors influencing school enrolment across the districts of Uttarakhand, a Himalayan state with unique geographical and infrastructural challenges. Using district-level data from UDISE across four time points (2012-2022), the study explored how enrolment varies by school infrastructure, management type, location, and geography. A multiple linear regression model was used, with log-transformed enrolment as the dependent variable.

The results show that management type and geography have the strongest and most consistent effects on school enrolment. On average, public schools enrolled 64% fewer students than private schools, after controlling for infrastructure, location, and time. This finding supports earlier research (e.g., Harma, 2010; Lahoti & Mukhopadhyay, 2019) indicating that parents increasingly prefer private schools, even low-fee ones, due to perceptions of better quality, discipline, and English-medium instruction.

Moreover, enrolment showed variation across geography and location in the analysis, showing divides or regional inequalities in education as a concern of the developmental debate. Enrolment in non-hilly areas was higher by 139 percentage points, and similarly, urban areas received 33% more children compared to rural areas. These inequalities raise concerns about infrastructural and logistical disadvantages faced by schools in difficult terrains (Kumar et al., 2018), and demand-side barriers such as poverty, migration, and lack of awareness in rural localities.

In terms of increasing accessibility by having schools available in localities within a comfortable reach, the analysis observes that a 10% increase in the number of schools was linked with a 9% increase in enrolment, suggesting that the availability of institutions still plays a major role in determining whether the child will go to school or not.



Interestingly, although our regression model does show that infrastructure, whether basic or didactic, has a positive relationship with enrolment, the result is not statistically significant. However, regional inequalities were also confirmed in the analysis of infrastructural differences across location, in the observation that private schools and urban schools have better infrastructure. Moreover, the analysis showing better infrastructure also supports the point made by Hanushek et al. (2004) that school choice is influenced by infrastructure or supportive facilities.

Interestingly, while infrastructure (both basic and didactic) showed positive but statistically insignificant effects on enrolment, these variables should not be dismissed. Their lack of significance may be due to limited variation across schools or because infrastructure impacts other outcomes – such as student retention, attendance, or learning – rather than just enrolment (Earthman, 2002; Cuesta et al., 2016; Maxwell, 2018; Lahoti and Mukhopadhyay, 2019). This was also observed in the analysis done by ASER (2022), which found that private schools perform slightly better in learning outcomes compared to public schools. Nonetheless, the direction of the relationship suggests that improving infrastructure could still be important in supporting overall educational quality.

The model also revealed a significant drop in enrolment in the year 2021-22, estimated at about 24.2% compared to 2012-13, pointing to the lasting effects of COVID-19 on school participation. These results align with broader evidence of educational disruption in India and other developing countries, particularly affecting children from marginalized households with limited access to digital learning (Bordoloi & Ranjan, 2021; UNICEF, 2021). However, the evidence we found on COVID in the rural economy, where the enrolment of private schools drops, also shows the fact that private schools – although better in infrastructure (statistically significant) and good at attracting parents – are not sustainable in the rural economy, showing their vulnerability in the presence of pandemic shocks. Adding to the discussion on management differences, we also observed that private schools are slightly better but not at all satisfactory when learning outcomes are the focus. Hence, we need more future research on the qualitative differences between private and public management types to understand better what could be done.

Hence, we can say this study also has some limitations. The data used for the analysis is secondary. Secondly, the demand-side or household factors such as income and parental education, which can influence enrolment, were not considered in the model, nor were they used to explain private and public-school differences. Lastly, the model does not capture quality-related factors like teacher effectiveness, cleanliness, and policies that may affect enrolment trends in the long term. However, still does not disturb the general applicability as we understood the differences, between the private and public, that people do prefer private, and there is good reason to do so as there exists differences in educational outcomes and infrastructure; keeping exceptions like COVID impacting the economy, making people and private schools more vulnerable to such shocks particularly in the rural areas. And what these differences means for public schools is to improve infrastructure and outcomes. While the limitations come in a way that this paper

does not tell whether the enrolment and educational outcomes is influenced by infrastructure quality, teaching quality, administrative policies, or other working conditions of the schools and therefore the paper dint argue what exactly to be improved to improve the outcomes. This can be explored under future research or can be explored in existing research as to how to improve outcomes.

However, what this paper can probably argue that if things go this way, the general trend between private and public schools will not change in the future and we can say that public schools act as a disguise until the private takes over or until people are not able to afford the private schooling. Hence, questioning the existence of the public schools and its services. So, we came up with two broad conclusions and suggestions on private–public dynamics:

- Parents prefer private schools, and infrastructure works as a moderating variable, so it should be addressed in public schools.
- During COVID, private schools failed, and they do not show satisfactory performance in learning outcomes, so we need to focus on the larger rural economy and monitor learning goals in both management types.
- Both type of schools, particularly public schools should focus on improving educational outcomes

Other suggestions may include expanding school coverage in underserved areas, addressing the perception and performance gap between public and private schools, and tackling barriers to access in geographically isolated and economically weaker regions.

Future research could delve into understanding the qualitative differences in management types, investigating the impediments to developing rural and hilly terrains, exploring demand-side issues in providing education, or asking questions about how much infrastructure is needed to set the base and beyond which further investment provides almost no returns. Moreover, further research could shift the outcome variable from enrolment to attendance, basic learning goals, or competency levels of children achieved in schools.

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