

# Literacy Development through Early Childhood Development Program in India

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## Abstract

This paper aims to analyze the relationship between early childhood development and education attainment in India. The human capital is considered as a major factor of high productivity. Education is likely to have a positive impact on economic growth through promoting human capital accumulation. We suppose that the early childhood development program would be an effective tool to stop the leak from schooling. We developed panel data to analyze the effect of early childhood development in district level of India. In this paper, empirical results show that primary schools with early childhood development program have positive effect on education attainment in primary schools.

## 1. Introduction

Over fifty years ago, the UNESCO constitution identified “Education for All (EFA)” as a key aspiration of the fielding organization on four conferences and meetings<sup>2)</sup>. (Birdsall, Levine, & Ibrahim, 2005) In 1990, the international community renewed its commitment to EFA at the Jomtien Conference, which initiated a decade of intense activity at both global and national level, to promote the development of basic education. According to UNESCO’s EFA Global Monitoring Report 2008, 51 out of 129 countries have achieved or are close to achieving the four most

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<sup>2)</sup> “Meetings of Representatives of Asian Members of States on primary and Compulsory Education” on Karachi, “Conference of African States on the Development of Education in Africa” on Addis Ababa, “Conference of Ministers of Education and Those Responsible for Economic Planning” on Santiago and “Conference of Ministers of Education and Ministers Responsible for Economic Planning in Arab States” on Tripoli.

quantifiable EFA goals (universal primary education, adult literacy, gender equality and quality of education), 53 are in an intermediate position and 25 are far from achieving EFA as a whole, the EFA Development Index shows. As concerns early childhood care and education (ECCE) or simply, early childhood development (ECD), the report pointed out that although child mortality rates have dropped, a majority of countries are not taking the necessary policy measures to provide care and education to children below age three; the provision of pre-primary education for children aged three and above has improved but remains scarce across sub-Saharan Africa, the Arab states and South Asia; ECCE programs generally do not reach the poorest and the most disadvantaged children, who stand to gain the most from them in terms of health, nutrition and cognitive development. According to UNICEF, investing in ECD program is useful in facilitating economic growth and transformation by giving parents and caregivers of children the opportunity and flexibility to join the labor force. ECD program in Brazil found that the program was reducing work of parents who formerly had to take time off to care for their children. An evaluation of home daycare program in Colombia demonstrated the twenty percent of the women with children in the program changed their employment status after putting their children daycare<sup>3)</sup>. Thus, ECD enables participants to earn more, raise their eventual productivity in the workforce, and enhance school readiness of children.

In India, progress towards this goal proved to be much slower than expected. India began its endeavour to establish a system of mass education more than fifty years ago. The Constitution of the country made it obligatory for the state to provide basic education up to the age of fourteen, within a period of ten years. While literacy rates and school enrollments increased consistently, however, persistent efforts to reach the goal of EFA seem to have begun paying results in recent years. The increase in literacy rate in the 1990s showed a significant jump and consequently, for the first time, there was a decrease in the absolute number of illiterates in the country. Female literacy showed a faster increase than the male literacy, although India still has a long way to achieve EFA in school dropout among them.

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<sup>3)</sup> Coclough (1980), "Primary Schooling and Economic Development"

### 1.1 Leading literatures using data from developing countries

Hanushek (2003) collected and analyzed the result of past education production functions. In his analysis, it appeared that there was no correlation with school inputs and pupil performance. Regarding this result, he concluded that ineffective distribution of educational resources interrupted with the improvement of students' achievements by school inputs. Ogawa and Nakamuro (2009) empirically examined relationship between school inputs and students' achievements in Vietnam by using the education production function analysis. The study of Vietnam found that in primary schools, infrastructure variables<sup>4)</sup> were positively correlated with students' achievements; which indicated to test scores of primary schools. Furthermore, teacher variables<sup>5)</sup> and the variables of public expenditure on education<sup>6)</sup> were also statistically significant for improving students' performance. There are numerous literatures analyzing relationship between school inputs and outputs, however most of econometric studies have been analyzing primary, secondary tertiary or vocational education as a matter of data availability in developing countries.

### 1.2 Early childhood development

ECD or ECCE is connected with the first of UNESCO EFA six goals<sup>7)</sup>. ECD refers

<sup>4)</sup> They utilized coefficients electricity, water resource, and sanitary toilets as representing infrastructure variables.

<sup>5)</sup> Teachers who have more than 10 years of experience

<sup>6)</sup> Construction funds provided by parents of students and communities wherein students have lived

<sup>7)</sup> 1. Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children. 2. Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality. 3. Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes. 4. Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults. 5. Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality. 6. Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.

to a comprehensive approach to policies and programs for children from birth to eight years of age and their parents or caregivers. Its purpose is to protect the child's rights to develop his or her full cognitive, emotional, social and physical potential. Community-based services that meet the needs of infants and young children are vital for ECD activity and they should include attention to health, nutrition, education and water sanitation in homes and communities. The approach promotes and protects the rights of the young child to survival, growth and development.

Dropout rate of primary education in India would make a u-shaped curve; grade-wise analysis shows that the rates of the initial and last grades are relatively higher than that of other grades. High dropout rate of grade I means that students fail habituating themselves to schools. As one follows up on the progress of India in the last decade, the goal of universalizing elementary education still seems very distant. While gross enrollment has, over the years, increased significantly, retention and completion rates are still causes for concern. Even among those who survive the five years in schools, levels of educational achievement are deplorably low. The National Sample Survey Organisation data<sup>8)</sup> reported that about forty-seven percent of the children dropped out of schools cite inability to cope academically and lack of interest in studies as the predominant reasons. Among the various child-specific social and personal variables that influence success at school, significant variables are the psycho-social and physical readiness of the child to negotiate the demands of primary education. The child's status vis-à-vis both habit formation and active learning capacity, on entry into primary schools, is influenced to a large extent by what the child actually brings with him or her to school in terms of not only pre-literacy skills, but also nutritional, health status and socio-economic backgrounds, extent of response to schools which tend to determine the quality and extent of response to school inputs. A look into India's past cultural heritage indicates that traditionally, the early childhood years were considered to lay the foundation for inculcation of basic values and social skills in children. The program would need to have some components of active parents' involvement in it as also a component of

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<sup>8)</sup> The National Sample Survey Organisation (now is National Sample Survey Office) is organization of Ministry of Statistic and Programme Implementation, the Government of India.

parents' education regarding developmentally appropriate and responsive parenting so as to ensure both continuities of the inputs for the children, and better parental acceptance of the play-based education program.

## 2. Data

### 2.1 Data resource

The district-wise<sup>9)</sup> data is mainly given from the Unified District Information System for Education (U-DISE)<sup>10)</sup> and the Census of India. Twenty-nine states and seven Union Territories of India are subdivided into one to seventy-five districts; therefore datasets with district-wise statistical data would be larger than state-wise datasets. U-DISE covers primary, upper primary, secondary and higher secondary schools of all districts in twenty-nine states and seven Union Territories. We developed panel data for year 2004 to 2014 from the U-DISE. Panel data usually give the researcher a large number of data points, increasing the degrees of freedom and reducing collinearity among explanatory variables, hence improving the efficiency of econometric estimates. In addition, panel data allow a researcher to analyze a number of important economic questions that cannot address using cross-sectional or times-series data. Panel data provide means of resolving the magnitude of econometric problems that often arise in empirical studies, namely the often-heard assertion that the real reason one finds certain effects is the presence of omitted, mismeasured, or unobserved variables that are correlated with explanatory variables.

Descriptive statistics of the samples are presented in Table 1. We limit the sample to select the districts where have never been divided or merged with other districts during sample year 2004-2014. Furthermore, we defined outliers if a value is larger or smaller than the median of all values by four multiplied

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<sup>9)</sup> Districts of India are administrative division of States and Union Territories. Thirty-six states and Union Territories are subdivided into districts. According to Census of India in 2011, there were 640 districts.

<sup>10)</sup> U-DISE was established by National Institute of Educational Planning and Administration, the Government of India.

standard deviation. Thus, we have finally 103 sample districts for 11 years. All variables except the number of students who passed examination are containing missing values. We utilize multiple imputation to supplement missing values and develop a balanced dataset. The sample size of the number of students who passed examination is smaller than other variables because of data availability of U-DISE. Therefore, the number of observations is 604 and we decided to develop pooling data for analysis of examination results as the number of students passed grade completion examination.

Table 1 Descriptive statistics of the samples

	Average	Median	Standard deviation	Number of obs.
Number of scheduled castes students enrollment (persons)	38254.38	24937.50	43105.24	1133
Number of scheduled tribes students enrollment (persons)	20789.94	8155	31426.05	1133
Number of other backward castes students enrollment (persons)	85290.26	61977	87953.01	1133
Number of Muslim students enrollment (persons)	27585.74	10932	48594.38	1133
Number of schools with ECD (schools)	423.97	210	733.40	1133
Number of schools with meal scheme (schools)	1055.72	898	845.56	1133
Number of teachers (persons)	2924.04	2289.50	2658.37	1133
Urban population (%)	23.03081	18.12	19.48106	1133
Literacy rate (%)	68.43022	72.74	20.86	1133
Number of students who passed examination (%)	90.78364	96.59	18.35641	604

## 2.2 Missing data imputation

Missing data are problems because nearly all standard statistical methods presume complete information for all the variables included in the analysis<sup>11)</sup>. A relatively few absent observations on some variables can dramatically shrink the sample size. As a result, the precision of confidence intervals is harmed, statistical power weakens and the parameter estimates may be biased. The frequencies of each missing data pattern and the number of missing values are shown in Table 2. All the variables except the number of students who passed examination are missing more than one value. Two variables, the number of primary schools with ECD and the number of primary schools with MDM are missing almost half of its values.

We used multiple imputation to handle these missing data. To impute the missing data, we constructed multiple regression models<sup>12)</sup> including variables potentially related to the fact that the data were missing and also variables correlated with that outcome. Multiple imputation provides a useful strategy in dealing with datasets with missing values. Instead of filling in a single value for each missing value, Rubin's (1987) multiple imputation procedure replaces each missing value with a set of plausible values that represent the uncertainty about the right value to impute. The imputation procedure uses all the known covariates thought to be associated with the missing mechanism. The results across two to three imputed datasets were combined by averaging, and standard errors. Datasets used to impute presented in Table 3; these datasets are selected to have correlation coefficients > 0.4 with dataset with missing values (Collins et al. 2001). Calculations were done in Stata 11, estimation with multiple regression applied to each imputed dataset separately. These estimates and their standard errors were combined using Rubin's rule. Imputed dataset were given from the Census of India in 2001 and 2011.

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<sup>11)</sup> According to Dermirtas and Hedeker (2008), 25% of missing rate is the upper limit to accurate estimation.

<sup>12)</sup> A regression model (below) is fitted for each variables with missing values, previous variables as covariates:

$$Y = \beta_0 + \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3,$$

where  $Y$  is a variable with missing values;  $Y_1$ ,  $Y_2$  and  $Y_3$  are imputed variables.

Table 2 Characteristics of missing data

Variables with missing values	Number of missing values	Number of obs.	Missing rate (%)
Number of scheduled castes students enrollment (persons)	3	1130	0.26478
Number of scheduled tribes students enrollment (persons)	3	1130	0.26478
Number of other backward castes students enrollment (persons)	119	1014	10.50309
Number of Muslim students enrollment (persons)	252	851	22.24183
Number of schools with ECD (schools)	471	662	41.57105
Number of schools with Mid Day Meal Scheme (schools)	586	547	51.72109
Number of teachers (persons)	3	1130	0.26478
Urban population (%)	13	1120	1.11473
Literacy rate (%)	5	1128	0.44131
Number of students who passed examination (%)	0	604	0

Table 3 Imputed datasets for missing data

Variables with missing values	Variables used for imputation
Number of scheduled castes students enrollment (persons)	Scheduled castes population of the district (persons) Number of primary schools of the district (schools) Number of scheduled castes teachers of the district (persons)
Number of scheduled tribes students enrollment (persons)	Scheduled tribes population of the district (persons) Number of primary schools of the district (schools) Number of scheduled tribes teachers of the district (persons)
Number of other backward castes students enrollment (persons)	Other backward castes population of the district (persons) Number of primary schools of the district (schools) Number of other backward castes teachers of the district (persons)
Number of Muslim students enrollment (persons)	Muslim population of the district (persons) Number of primary schools of the district (schools) Number of Muslim teachers of the district (persons)
Number of schools with ECD (schools)	Number of primary schools of the district (schools) Public expenditure on education of the district (million rupees) Number of ECD centers of the district (buildings)
Number of schools with Mid Day Meal Scheme (schools)	Number of primary schools of the district (schools) Government expenditure on Mid Day Meal Scheme (10 million rupees)
Number of teachers (persons)	Number of primary schools of the district (schools) Number of students in primary school of the district (persons) Public expenditure on education of the district (million rupees)
Urban population (%)	Total population of the district (persons) Rural population of the district (persons)
Literacy rate (%)	Public expenditure on education of the district (million rupees) Literacy rate of the state that the district belonged to (%)

### 3. Model and Method

#### 3.1 Education production function analysis

To analyze the effect of educational inputs on output throughout India, we use the education production function. A production function allows an analysis of inputs and results, it searches to describe higher level of production and it is interested, in addition, by the analysis of options to obtain a maximum possible product level, using determined inputs; thus the production function is a very useful instrument since it allows to describe the levels of greater efficiency and to observe impacts of possible changes in the inputs or technological changes. The model in use is based on the model used by Ogawa and Nakamuro (2009)<sup>13</sup>.

$$S = m_1(X_S) + m_2(X_{NS})$$

$S$  indicates the dependent variable and  $X_S$ ,  $X_{NS}$  indicate independent variables. In their model, examination result and repetition rate are considered as  $S$ , which is explained by  $X_S$ , school inputs and  $X_{NS}$ , non-school inputs or student attributes. Their studies in Vietnam found that in primary schools, infrastructure variables were positively correlated with students' achievements, which are indicated by examination scores. Furthermore, teacher variables and public expenditure on education variables were also statistically significant to improving the performance of students.

#### 3.2 Model in this study

To analyze the relationship among school inputs and output, we substituted the number of schools with ECD program, the number teachers and the number of

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<sup>13</sup> Ogawa, Nakamuro(2009), "Estimates of Education Production Function and Its Cost-Effectiveness Analysis: The Case of Vietnam"

schools with the Mid Day Meal Scheme (MDM)<sup>14)</sup> for school inputs, and literacy rate and the number of students passed grade completion examination indicated as percentage to all students for school output. We suppose that the number of primary schools with ECD centers/programs and MDM program decrease dropout especially at the first grade of schools and increase educational attainment of students by enhancing their school readiness. We added urban population rate to subtract effect of students from relatively rich households who are living in urbanized areas. Regarding student attributes, enrollment number of scheduled castes, scheduled tribes, other backward castes and Muslim students are assumed that these groups who usually show low approaches of educational indicators have negative effect to dependent variables.

$$S_{dt} = \alpha_1 SC_{dt} + \alpha_2 ST_{dt} + \alpha_3 OBC_{dt} + \alpha_4 MUS_{dt} + \beta_1 TER_{dt} + \beta_2 PRE_{dt} + \beta_3 MDM_{dt} + \beta_4 URB_{dt} + \varepsilon_{dt}$$

where subscripts  $d$  and  $t$  represent districts and year respectively.

In this model, dependent variable  $S$  is examination result as percentage of students who passed grade completion examination of the first grade and literacy rate. Independent variables are school inputs and students attributes. School inputs are  $TER$ ; the number of teachers of public primary schools,  $PRE$ ; the number of public primary schools with ECD centers/programs, and  $MDM$ ; the number of public primary schools with MDM. Student attributes are  $SC$ ; the number of scheduled castes students enrollment,  $ST$ ; the number of scheduled tribes students enrollment,  $OBC$ ; the number of other backward castes students enrollment,  $MUS$ ; the number of Muslim students enrollment, and  $URB$ ; percentage of population

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<sup>14)</sup> The Mid Day Meal Scheme is a school meal program designed to improve the nutritional status of school-age children nationwide by Department of School Education & Literacy, Ministry of Human Resource Development. The program supplies free lunches on working days for children in primary and upper primary classes in government, government aided, local body, Education Guarantee Scheme, and alternate innovative education centers, and Madrasas supported under Sarva Shiksha Abhiyan, and National Child Labour Project schools run by the Ministry of labor.

living in urban areas.

#### **4. Analysis**

##### **4.1 Result of multiple regression analysis**

First, the Hausman test was applied for the model specification whether fixed or random effect model should be utilized to analyze. The result of the test 0.00553 indicates fixed effect model is appropriate. We also utilized the F-test for model specification. According to these two tests, one-way fixed effect model is appropriate for estimation.

Table 4 shows results of one-way fixed effect model estimating the impact of ECD and MDM on the literacy attainment. The analysis of multiple regression of the literacy rate shows that primary schools with ECD program and MDM are statistically significant. Coefficients ECD and MDM are positively connected to literacy attainment of students. The coefficient of ECD equals to 0.00750, which implies that if one primary school with ECD were built in the district, literacy rate of the district would increase by 0.75%. The coefficient of MDM equals to 0.01731, which implies that if one primary school with MDM were built, the literacy would increase by 1.73%. Other backward castes and Muslim enrollment show significant relationship with literacy but coefficients are small. The positive effect of these social groups might imply the effect of NGOs, however coefficients of scheduled castes and tribes do not appeared to be significant. This might indicate that the Reservation System of India<sup>15)</sup> for selected social groups would fail to promote them to catch-up with other groups in terms of education. Urban population shows strong positive significance with literacy rate.

Table 5 presents results of OLS model estimating the effect of ECD and MDM on examination results of primary schools. The result of multiple regression of the number of students who passed examination shows similar pattern to results of Table 4. ECD and MDM are statistically significant and have positive effect on examination result. The coefficient of ECD equals to 0.37855, which implies that a

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<sup>15)</sup> Reservation in India is the process of facilitating a person in education, scholarship, jobs, and in promotion who has category certificates.

new primary school with ECD increase the number of students who passed grade completion examination by 37.86%. The coefficient of MDM equals to 0.09310, which implies that a new primary school with MDM increase the number of students who passed the examination by 9.31%. The percentage of urban population shows positive correlation with both literacy and examination results; this means that education system in India still needs to be marginalized in rural areas. The number of teachers of primary schools do not appeared to be significant in both literacy and examination results.

Table 4 Result of multiple regression analysis of literacy rate

Estimation method	One-way fixed effect model	
Constant term	66.91275	
Independent variable	Partial regression coefficient	Standard error
Number of scheduled castes students enrollment (persons)	-0.00000	0.00007
Number of scheduled tribes students enrollment (persons)	0.00000	0.00006
Number of other backward castes students enrollment (persons)	0.00016***	0.00038
Number of Muslim students enrollment (persons)	0.00028***	0.00064
Number of teachers (persons)	0.00181	0.00019
Number of schools with ECD centers/programs (schools)	0.00750*	0.00024
Number of schools with MDM (school)	0.01731***	0.00023
Urban population (%)	0.07912***	0.04191
R-squared	0.943	
Adjusted R-squared	0.852	
Hausman test	0.00553	
Number of obs.	1133	

\*, \*\* and \*\*\* represent  $p < 0.1$ ,  $p < 0.05$  and  $p < 0.01$  respectively.

Table 5 Result of multiple regression analysis of examination result

Estimation method	OLS model	
Constant term	22.78790	
Independent variable	Partial regression coefficient	Standard error
Number of scheduled castes students enrollment (persons)	-0.08521	0.00301
Number of scheduled tribes students enrollment (persons)	-0.14464	0.05035
Number of other backward castes students enrollment (persons)	-0.36855	0.01100
Number of Muslim students enrollment (persons)	0.37855*	0.04297
Number of teachers (persons)	0.09310	0.03479
Number of schools with ECD centers/programs (schools)	0.37855**	0.00240
Number of schools with MDM (schools)	0.09310*	0.00230
Urban population (%)	0.19310**	0.42912
R-squared	0.655	
Adjusted R-squared	0.577	
Number of obs.	604	

\*, \*\* and \*\*\* represent  $p < 0.1$ ,  $p < 0.05$  and  $p < 0.01$  respectively.

#### 4.2 Robustness check

We examine robustness of our estimation model in three cases, 1) with all variables; 2) without variables of scheduled castes, scheduled tribes, other backward castes and Muslim; and 3) without the variable of urban population that is strongly related with school achievements. Table 6 presents the results of the robustness check. Column 1 presents the results of multiple regression with all variables; column 2 presents the results without variables of the number of scheduled castes, scheduled tribes, other backward castes and Muslim students; column 3 presents results without urban population rate. In all three cases, both coefficients representing the number of schools with ECD program and schools with MDM show consistently stable and statistically significant on literacy rate and examination result.

Table 6 Result of robustness check

Dependent variable	Literacy rate (%)		
	(1) All variables	(2) Without variables of scheduled castes, scheduled tribes, other backward castes and Muslim	(3) Without urban population variable
Number of scheduled castes students enrollment (persons)	-0.00000	-	-0.00000
Number of scheduled tribes students enrollment (persons)	0.00000	-	0.00000
Number of other backward castes students enrollment (persons)	0.00016***	-	0.00001**
Number of Muslim students enrollment (persons)	0.00028***	-	-0.00003***
Number of teachers (persons)	0.00075*	0.00009***	0.00008**
Number of schools with ECD centers/programs (schools)	0.093102*	0.00189***	0.00164***
Number of schools with MDM (schools)	0.01731***	0.00068**	0.00213
Urban population (%)	0.07912***	0.06856***	-
R-squared	0.943	0.577	0.655
Adjusted R-squared	0.852	0.2729	0.096
Number of obs.	1133	1133	1133
ependent variable	Number of students who passed examination (persons)		
Independent variables	(3) All variables	(4) Without variables of scheduled castes, scheduled tribes, other backward castes and Muslim	(3) Without urban population variable
Number of scheduled castes students enrollment (persons)	-0.08521	-	-0.08211

Number of scheduled tribes students enrollment (persons)	-0.14464	-	-0.12885
Number of other backward castes students enrollment (persons)	-0.36855	-	-0.27655
Number of Muslim students enrollment (persons)	0.378549*	-	-0.00003***
Number of teachers (persons)	0.093102	0.082112	0.089744
Number of schools with ECD centers/programs (schools)	0.378549**	0.00189***	0.00154**
Number of schools with MDM (schools)	0.093102*	0.00852*	0.00644*
Urban population (%)	0.193102**	0.17852**	-
R-squared	0.655	0.342	0.445
Adjusted R-squared	0.577	0.174	0.084
Number of obs.	604	604	604

\*, \*\* and \*\*\* represent  $p < 0.1$ ,  $p < 0.05$  and  $p < 0.01$  respectively.

## 5. Concluding Remarks

According to the results of multiple regression analysis, ECD program is positively correlated with literacy rate and examination performance of students in primary schools. We suppose that these results proved that the positive effect of primary schools with ECD or MDM reduce dropout and increase education outcome than schools without ECD programs or MDM. ECD program is useful in facilitating economic growth and transformation by giving parents and caregivers of children the opportunity and flexibility to join the labor force. Besides, it is important for investors whether the estimated variables that have positive effect are also cost-effective.

In this analysis, school input variables are appeared significantly positive on education attainment; however, school inputs are put pressure from teachers' (especially principals and teachers who have much experiences) salary expensive

for developing countries. Furthermore, the coefficient representing the number of teachers does not show significant impact. This could be the result of low quality of primary school teachers and quality of classrooms. This paper proves quantitative relation between ECD and education outcomes in India however, quality-related variables are not included in estimation model. Variables reflecting quality of education or teachers such as the number of teachers with master degree would be important to further analysis.

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