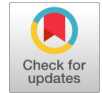


Education Infrastructure, Expenditure, Enrollment & Economic Development in Odisha, India

Swarna Prava Hota, Sanat Kumar Acharya



Abstract: A key part of human capital is education. The development of educational infrastructure and economic growth are closely linked. Realizing the value of infrastructure, both the central and the state government have implemented a number of programmes to upgrade the physical facilities at public schools. Infrastructure is a key component of enabling high-quality education. This study intends to explore the linkage between economic development and spending on education for infrastructure development and quality of education. In 2019–20, the ratio of education department spending (revenue and capital account) to the gross state product (GSDP) is 2.84%. In 2020–21, the gross enrollment ratios (GER) for primary and secondary education are 97.4% and 84.5% respectively. As part of the study's methodology, analytical and empirical data from secondary sources were compiled. The multiple regression analysis demonstrates that the GER of primary and secondary education, as well as the expenditure (Revenue and Capital) on education by education departments to GSDP is significant to economic growth. Here, the economic growth of Odisha as a whole is significantly influenced by the state's educational system. The study's conclusions show that public spending on infrastructure and education has a big impact on economic growth. It is recommended that the infrastructure in schools should be well-equipped in order to meet the needs of the current generation. The government should collaborate with private corporate sector, industrial unit in constructing the infrastructural facility such as smart class room, computer and internet facility, laboratory etc in schools.

Keyword: Infrastructure, Economic Growth, Expenditure, JEL
Classification Codes: H54, O4, H52

I. INTRODUCTION

Infrastructure plays a key role in enabling high-quality education and economic development. Education is one of the most effective tools for alleviating poverty, reducing inequality, and improving global competitiveness. According to endogenous growth model, public authority policy has an active role in promoting in economic development through direct and indirect investment in human capital (education), infrastructure and research development. Availability of physical Infrastructures are very critical for satisfactory quality in education. These physical infrastructures embrace provision of building, toilets, drinking water facility, electricity, computers, etc.

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However, there is no particular indicator which will represent the infrastructure development of any school.

According to Right to Education Act (RTE) 2009 & National Education Policy (NEP) 2020, adequate and safe infrastructure will be provided to all schools, including functional common rooms, clean drinking water, clean and appealing spaces, electricity, computing devices, internet, libraries, and sports and recreational resources to ensure that teachers and students including children of all genders and children with disabilities receive a safe, inclusive and effective learning environment. One of the main drivers of economic development in any state or nation is infrastructure development. India's literacy rate has been steadily increasing from 64.8% in the 2001 census to 74.04% in 2011. (census data). The necessity for "education for all" has received more attention from both the central and state governments.

Any nation's human growth must include education as a key component. Low productivity and low economic growth might result from a lack of human capital. The growth and development of a state depend heavily on the development of its infrastructure. Therefore, the availability of infrastructure in quantity and quality as well as its accessibility to the target beneficiaries could be viewed as development parameters.

II. REVIEW OF LITERATURE

Birhhal, P.S., H. Singh & S. Kumar (2011) demonstrated that while physical infrastructure and human capital alone are insufficient to achieve convergence, they do improve economic growth.

Majhi, H. & Mallick, M. (2019) depicted that infrastructure has a big impact on how many students enrol in elementary school. Over time, there is an increase in enrollment. The accessibility of basic amenities is enticing kids, particularly girls, to attend school. Additionally, it has been noted that with time, the infrastructure in districts like Balasore, Boudh, Keonjhar, and Kalahandi is improving.

Babatunde, S.A. (2018) indicated that Government spending on transportation and communication, education, and health infrastructure, has a significant positive impact on economic growth. Government spending on agriculture and natural resource infrastructure, however, had a significant negative impact on economic growth.

According to Kaur, A. & Kaur, R. (2018), a multiple regression model can be used to determine how economic infrastructure, such as roads and bridges, affects the NSDP per capita.



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According to the study, Punjab's economic development is significantly impacted by the health infrastructure index, the economic infrastructure index, and neither significantly nor insignificantly by the education infrastructure index. According to the study's findings, economic infrastructure has grown more rapidly than social infrastructure.

Sharma, G. & Sharma, D. (2017) indicated that When examined separately, not all of India's States and Union Territories show a rise in the Gross Enrolment Ratio (GER) from 2012–13 to 2015–16, The effectiveness of the resources allocated to education in advancing the cause of social and economic development must be improved because resources are scarce. To raise the standard of education in emerging nations, a thorough structural transformation is required.

Nayak, PM & Palita, S. (2021) highlighted that several issues affect the quality of primary education in schools. However, while public schools have better physical infrastructure facilities, they offer very poor education when it comes to student achievement. On the other hand, the infrastructure available in private schools is relatively poor, combined with very poor infrastructure, specifically untrained teachers, and high educational costs, making it difficult for poor parents to raise their students.

III. OBJECTIVES OF THE STUDY

1. To study the significance of school infrastructure and enrollment in education in economic growth of Odisha.
2. To analyse the impact of expenditures on education on economic growth.

A. Research Methodology & Data Sources

Secondary data relating to number of schools, gross enrolment, availability of infrastructural facilities, Educational Expenditure and Gross State Domestic Product (GSDP) for the year 2005 to 2021 of Odisha have been collected from The Ministry of Education, Government of India, Directorate of Mass Education, Government of Odisha, various articles, government websites for this study.

Education is a key indicator of human development. Education not only provides knowledge and skill but also

plays an important role in developing social, cultural and moral values in an individual. The research uses the secondary data as shown in table 1

Table-1: Data Set

Variable	Explanation	Data Source
GSDP	Gross State Domestic Product	Directorate of Economics & Statistics, Odisha
GER	Gross Enrollment Ratio	UDISE+Dashboard, Ministry of Education-Government of India, OSEPA,
No of School	-	UDISE+Dashboard, Ministry of Education-Govt .of India
BEE	Budgeted Expenditure on education	Ministry of Education, Govt. of India
E.I	Education Infrastructure	UDISE+Dashboard, Ministry of Education-Government of India

B. Hypothesis

H0: There is no significant relation in between Expenditure on education and GER with GSDP growth.

H1: There is significant relation in between Expenditure on education and GER with GSDP growth.

C. Data Analysis & Findings

Simple statistical tools like trend analysis, growth rate, correlation, multiple regression analysis are used to elaborate the findings. The spending on education, infrastructures trend and GER of education undertaken by Odisha State are taken into consideration.

D. Education Infrastructures and Growth Outcome

Educational dimensions in the present study are measured by school enrolment ratios and government expenditure on education and infrastructure availability. Enrolment ratios are chosen specifically because; they are associated with the education for all. As many developing economies are faced with resource constraints, the issue of allocating resources efficiently to maximize growth outcomes is a necessity. Government expenditure (Revenue and Capital) for providing educational infrastructures is important for enrollment as well as economic growth in state. The government is spending resources to increase infrastructures facility for betterment of education quality.

Table-2: Total No of Schools

Year	Elementary School			Secondary School			Higher Secondary School			Total
	Primary (I-V)	Upper Primary (I-VIII)	Upper Primary (VI-VIII)	SS (I-X)	SS (VI-X)	SS (IX-X)	HSS (I-XII)	HSS (VI-XII)	HSS (XI-XII)	
2012-13	37332	16551	4131	1740	7271	189	75	34	0	67323
2013-14	37695	16614	4126	1754	7225	188	79	36	0	67717
2014-15	38249	16826	4121	1749	7291	180	85	37	0	68538
2015-16	38663	17111	4091	1771	7291	176	92	36	1069	70300
2016-17	38360	17361	4178	1875	7279	184	105	37	1179	70558
2017-18	36070	18716	3303	2681	4094	2681	187	222	1247	69201
2018-19	34954	18981	2869	3524	3776	2214	197	250	1952	68717
2019-20	33340	19094	2625	3629	3629	2257	206	298	1942	67020
2020-21	30377	19238	2601	3736	3452	2331	206	292	1952	64185
2021-22	29326	18550	2499	3734	3371	2392	211	328	1880	62291

Various segment of class level are shown in Table-2. The trend of Primary (I-V) and upper primary (I-VIII) level school are shown highest among all categories. Out of total 62291 schools in 2021-2, primary level (I-V) and upper primary (I-VIII) represent 47% and 29.8% and Higher Secondary School (HSS) (I-XII) is lowest i.e. 0.3%.



The numbers of schools have been reduced from 67020 in 2019 to 62291 in 2021-22 due to impact of pandemic. The total no of schools declined after 2016-17 due to implementation of merger of schools with different sections functioning within 500 meter distance and closure of schools functioning less than 10 students as per Niti Ayog. The various key infrastructures exist in schools are given below.

Table-3: Infrastructure Facilities in Elementary Schools

Year	School	Computer		Internet		Electricity		Toilet		Drinking Water		Playground		Land		Library	
	no	no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%
2012-13	58014	4230	7.3	27	0.05	10680	18.4	39697	68.4	---	---	16895	29.1	41870	72.2	43948	75.8
2013-14	58435	4832	8.3	44	0.08	11951	20.5	55569	95.1	---	---	20793	35.6	45305	77.5	49631	84.9
2014-15	59196	5141	8.7	78	0.13	13025	22.0	56316	95.1	---	---	22151	37.4	46417	78.4	53750	90.8
2015-16	59865	5498	9.2	111	0.19	14658	24.5	59211	98.9	59606	99.6	23566	39.4	46649	77.9	54963	91.8
2016-17	59899	6072	10.1	150	0.25	16276	27.2	59460	99.3	54054	90.2	25476	42.5	46959	78.4	55448	92.6
2017-18	58089	6058	10.4	1231	2.12	16666	28.7	57549	99.1	57663	99.3	24759	42.6	45315	78.0	54599	94.0
2018-19	56804	2407	4.2	21	0.04	16328	28.7	56598	99.6	56804	100.0	56804	100.0	44579	78.5	53489	94.2
2019-20	55059	5666	10.3	1776	3.23	33988	61.7	53573	97.3	55058	100.0	31668	57.5	40473	73.5	52023	94.5
2020-21	52216	5874	11.2	1987	3.81	35068	67.2	51580	98.8	51925	99.4	30754	58.9	38422	73.6	47806	91.6
2021-22	50375	6500	12.9	5067	10.06	36945	73.3	49423	98.1	49773	98.8	29374	58.3	36094	71.7	47528	94.3

From the table-3, it is observed that electric connection in elementary schools is in increasing trend and 73.3% in 2021-22. More than 98% of schools are having toilet & drinking water facilities and also it needs further attention to increase. Playground facility is not adequate in schools and it needs to enhance. More than 70% of school is having land facility. 94% of schools having library facility (in 2021-22). Computer and internet facility are in increasing trend and also it needs to further enhance for digital and quality of education.

Table-4: Infrastructure Facilities in Secondary Schools

Year	School	Computer		Internet		Electricity		Toilet		Drinking Water		Playground		Land		Library	
	no	no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%
2012-13	9200	2003	21.8	394	4.28	5314	57.8	7630	82.9	---	---	6370	69.2	7092	77.1	7541	81.967
2013-14	9167	2235	24.4	440	4.80	5630	61.4	8982	98.0	---	---	6898	75.2	7735	84.4	8168	89.102
2014-15	9220	4154	45.1	1038	11.26	6019	65.3	8942	97.0	---	---	7069	76.7	7910	85.8	8769	95.108
2015-16	9238	4396	47.6	1585	17.16	6358	68.8	9113	98.6	9217	99.8	8028	86.9	8810	95.4	8833	95.616
2016-17	9338	4663	49.9	1882	20.15	6617	70.9	9154	98.0	8393	89.9	8023	85.9	9013	96.5	8859	94.87
2017-18	9456	4966	52.5	2104	22.25	7062	74.7	9372	99.1	9317	98.5	8294	87.7	9343	98.8	9173	97.007
2018-19	9514	4278	45.0	4235	44.51	7320	76.9	9466	99.5	9514	100.0	11466	120.5	9742	102.4	9232	97.036
2019-20	9515	9515	100.0	1689	17.75	8151	85.7	8688	91.3	8143	85.6	9876	103.8	10046	105.6	9203	96.721
2020-21	9519	5329	56.0	1682	17.67	8298	87.2	9364	98.4	9482	99.6	9796	102.9	10004	105.1	9044	95.01
2021-22	9497	6133	64.6	2367	24.92	8514	89.6	9365	98.6	9435	99.3	9987	105.2	9934	104.6	9232	97.21

From the table-4, it is shown that electric connection in secondary schools is in increasing trend and 89.6% in 2021-22. 98% of schools are having toilet & drinking water facilities in 2021-22. Playground & land facilities are showing better from 2018-19. 97% of schools is having library facility (in 2021-22). Computer and internet facilities are showing increasing and also it needs further enhancement for better education.

Table-5: Infrastructure Facilities Higher Secondary Schools

Year	School	Computer		Internet		Electricity		Toilet		Drinking Water		Playground		Land		Library	
	no	no	%	no	%	no	%	no	%	no	%	no	%	no	%	no	%
2012-13	109	93	85.3	81	74.3	107	98.2	100	91.7	---	---	105	96.3	64	58.7	91	83.5
2013-14	115	96	83.5	89	77.4	112	97.4	114	99.1	---	---	110	95.7	77	67	101	87.8
2014-15	122	107	87.7	105	86.1	120	98.4	122	100	---	---	112	91.8	82	67.2	115	94.2
2015-16	1197	675	56.4	635	53	1042	87.1	1131	94.5	1133	94.7	912	76.2	867	72.4	1071	89.5



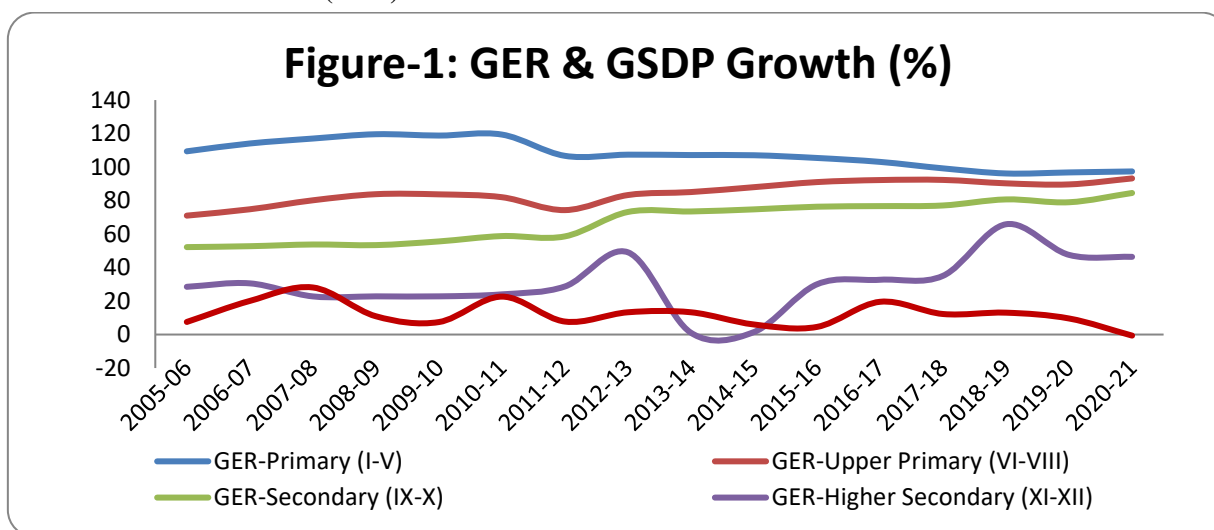
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2016-17	1321	830	62.8	773	58.5	1197	90.6	1284	97.2	1252	94.8	1042	78.9	1033	78.2	1237	93.6
2017-18	1656	1043	63	983	59.4	1535	92.7	1641	99.1	1603	96.8	1338	80.8	1336	80.7	1514	91.4
2018-19	2399	78	3.3	44	1.8	2386	99.5	2397	99.9	2399	100	2399	100	1737	72.4	2324	96.9
2019-20	2446	2129	87	863	35.3	2109	86.2	1970	80.5	2444	99.9	1984	81.1	2082	85.1	2185	89.3
2020-21	2450	1470	60	991	40.4	2126	86.8	2254	92	2229	91	1841	75.1	1991	81.3	2018	82.4
2021-22	2419	2143	88.6	1850	76.5	2288	94.6	2380	98.4	2358	97.5	2064	85.3	2058	85.1	2200	90.9

As per table-3. 94.6% of school having electric connection (2021-22) and all schools need to be connected with electricity.

Toilet facility is in increasing tend from 2019-20. Drinking water facility is 97.5% in 2021-22 and all schools should be available with drinking water facility. Playground facility is inadequate and it needs to give more focus. 85% of schools are having land facility (2021-22). All schools are not having 100% library facility and it is 91% in 2021-22. Computer and internet connection facility are dropped in 2018-19 and government should give more attention to increase computer and internet facilities in schools.

E. Gross Enrollment Ratio (GER)



Gross Enrollment in elementary, secondary, higher secondary education has started decreased in 2018-20 due to influence of corona virus. The growth rate of enrolment in elementary education is also higher than rate at secondary education. As for the correlation between GSDP growth rate and primary school enrollment, it demonstrates positive correlation (0.42) relationship between them. There is a positive relationship which means that, school enrollment ratios have been improving, the GDP growth rate has been increasing year by year. GER in secondary school is in increasing trend and 84.52% in 2020-21 which needs further enhancement. GER in higher secondary education is 46.4% in 2020-21. The GER in secondary and higher secondary level is low due to students are not continuing their education after elementary level. They are engaged in different unorganized sector for their earning. However, it is worthy to mention that, school enrollment ratios are the measures of quantitative education.

F. Expenditure on Education & Economic Growth

Table-6: Expenditure on Education by Education Department in INR Cr

Year	Gross State Domestic Product (GSDP) at Current Price	Expenditure on Education by education Dept (Revenue Account)	Expenditure on Education by education Dept (Capital Account)	Total Expenditure on Education by Education Dept (Revenue & Capital Account)	% Expenditure on Education by Education Dept (Revenue Account) vs GSDP	% Expenditure on Education by Education Dept (Capital Account) vs GSDP	% Total Expenditure on Education by Education Department (Revenue+Capital Account) vs GSDP
2005-06	95330.16	1971.4	0.6304	1972.0304	2.07	0.001	2.07
2006-07	114456.95	2343.3155	0.0004	2343.3159	2.05	0.000	2.05
2007-08	146629.71	2726.943	0.0003	2726.9433	1.86	0.000	1.86
2008-09	162654.9	3552.4765	---	3552.4765	2.18	0.000	2.18
2009-10	174778.51	5426.0839	32.9238	5459.0077	3.10	0.019	3.12



2010-11	214373.08	6066.339	70.8994	6137.2384	2.83	0.033	2.86
2011-12	261699.6	6421.0126	77.0685	6498.0811	2.45	0.029	2.48
2012-13	261699.6	7715.5135	236.7585	7952.272	2.95	0.090	3.04
2013-14	296475.38	8881.6462	256.8951	9138.5413	3.00	0.087	3.08
2014-15	314249.95	10236.6912	277.6323	10514.3235	3.26	0.088	3.35
2015-16	328549.5	11873.6742	368.4558	12242.13	3.61	0.112	3.73
2016-17	392803.67	9376.094	275.3151	9651.4091	2.39	0.070	2.46
2017-18	440974.79	11005.2991	509.4845	11514.7836	2.50	0.116	2.61
2018-19	498576.56	13800.141	447.7866	14247.9276	2.77	0.090	2.86
2019-20	546413.53	15143.3679	382.0004	15525.3683	2.77	0.070	2.84

As per table-6, it is observed that government is spending 2.84% total expenditure (Revenue and capital) on education and Capital expenditure towards infrastructure is very less i.e 0.07% in 2019-20. The total expenditure on education is decreased due to epidemic in 2019-20. Government need to spend more on education including infrastructure development to ensure quality of education as well as increase enrollment.

G. Multiple Regression Analysis:

Table-7: Variables for Multiple Regression Analysis

Table-7: Variables for Multiple Regression Analysis		
Dependent variable	Independent Variables	Use of Software
% GSDP Growth –Current Price	a) % of total expenditure (Revenue and Capital) on education-by-education dept to GSDP b) % GER-Primary (I-VI) c) % GER-Upper Primary (VI-VIII) d) % GER – Secondary (IX-X) e) % GER-Higher Secondary (XI-XII)	Minitab

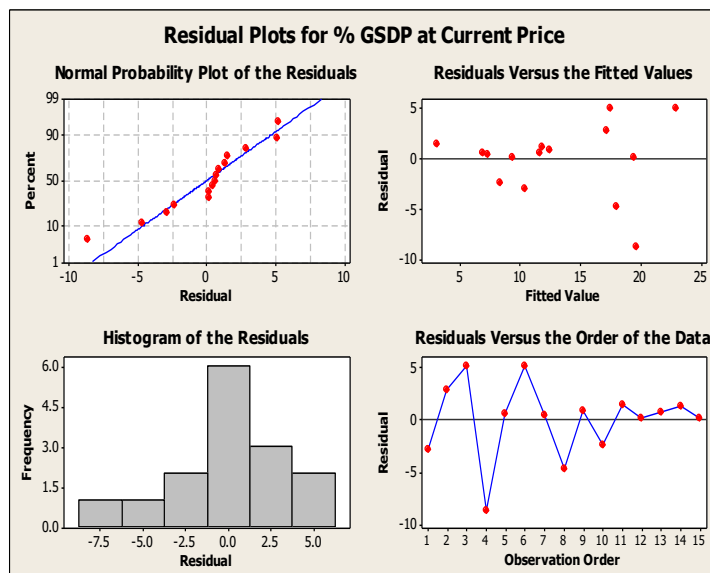
The Regression Equation is

$$\% \text{ GSDP at Current Price} = -173 - 15.7 \% \text{ Total Expenditure on Education by Education Dept (Revenue +Capital account)} + 1.59 \text{ GER-Primary (I-V)} - 0.508 \text{ GER-Upper Primary (VI-VIII)} + 1.45 \text{ GER-Secondary (IX-X)} + 0.0862 \text{ GER-Higher Secondary (XI-XII)}$$

Coefficients				
Predictor	Coef	SE Coef	T	P
Constant	-172.91	56.96	-3.04	0.014
% Total Expenditure on Education by Education Dept (Revenue+Capital Account)	-15.688	3.736	-4.2	0.002
GER-Primary (I-V)	1.587	0.4698	3.38	0.008
GER-Upper Primary (VI-VIII)	-0.508	0.4191	-1.21	0.257
GER-Secondary (IX-X)	1.451	0.5062	2.87	0.019
GER-Higher Secondary (IX-XII)	0.086	0.08791	0.98	0.352

Model Summary		
S = 4.46358	R-Sq = 72%	R-Sq(adj)= 56.40%

Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	5	460.47	92.09	4.62	0.023
Residual Error	9	179.31	19.92		
Total	14	639.78			



IV. INTERPRETING THE RESULTS

The results of the regression analysis demonstrate that the model is significant at an alpha level of 0.05 as indicated by the p-value in the analysis of variance table (0.023). The p-value for the estimated coefficients of % of total revenue & capital expenditure on education to GSDP, % GER-Primary (I-VI), GER-Secondary (IX-X) are indicating that they are significantly related to % GSDP growth at current price.

According to the R² sq. value, predictors account for 72% of the variation in GSDP increase. The number of predictors in the model is taken into account by the adjusted R² value, which is 56.4%. Both values indicate that model fits the data well. The complete significance of model was tested by ANOVA. The F-statistics value of 4.62 (P<0.05) indicates that the various parameters are statistically significant together at the 5% level and the null hypothesis (H₀) is rejected. As a result, total revenue and capital expenditure on education and GER have a large impact on the economy growth (p <0.05). A normal distribution-like pattern can be seen in the residuals' histogram. A roughly linear pattern compatible with a normal distribution can be seen on the normal probability plot. The plot of residuals versus fitted values reveals that when the fitted values grow, the residuals get smaller (closer to the reference line), which may suggest the residuals have no constant variance.

V. SUMMARY & CONCLUSION

It is widely acknowledged as a crucial investment in fostering human capital that influences growth in two ways: first, human capital levels serve as a catalyst for technical innovation, and second, the stock of human capital determines how quickly technology is adopted. Primary education is the most crucial type of education since it forms the cornerstone of a state as well as country's development.

Government is spending 2.84% total expenditure (Revenue and capital) against GSDP on education and development. Capital expenditure need be enhanced for better quality of education. The growth rate of enrolment in primary education (97.4% in 2020-21) is also higher than rate at secondary education. More than 95% of schools are having drinking water and toilet facility. But all schools should be equipped with drinking water and toilet facilities. Importance of electricity connection, computer and internet in secondary and higher secondary education is inadequate which need to be further enhanced. As per Multiple Regression Analysis, total expenditure (Revenue +Capital) to GSDP, GER-Primary (I-VI) and Secondary (VI-VIII) are significant (p<0.05) to GSDP growth at current price in Odisha. The vocational training and skill development programme should be emphasized at every grampanchayat level so that entrepreneurial capability can be developed.

The effectiveness of the resources allocated to education in advancing the cause of social and economic development must be improved because resources are scarce. To raise the standard of education in emerging nations, a thorough structural transformation is required.

The development of infrastructure in education without such facilities may be pushed by policymakers, NGOs, political leaders, and other investment organizations making

elementary and secondary education more alluring and digitalizing in the near future.

The state should formulate appropriate policy for preparation of need based and local specific planning and spend fund on education in order to raise educational standards, which will then boost economic development. With an emphasis on converting education into economic growth, education policy makers should develop better programmes and policies such as increasing the number of qualified teachers, collaboration with various enterprises to provide infrastructure facilities. The study makes it very evident that investing in education has a favourable and considerable impact on economic growth.

In general, all levels of government should place a high focus on the growth of the infrastructure sector. A firm and stable foundation must be set in the infrastructure sector for the economy to flourish in any significant way.

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Ethical approval and consent to participate	No, the article does not require ethical approval and consent to participate with evidence.
Availability of data and material	Not relevant.
Authors contributions	All authors have equal participation in this article.

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