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EDUCATIONAL TECHNOLOGY INTEGRATION: A COMPARATIVE STUDY IN INDIAN SCHOOLS

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Abstract

"Educational Technology Integration: The article, "Technology Integration Approaches in Indian Schools: A Comparative Study", analyses how technologies are used in Indian schools which have different approaches toward the integration of technology. The solution to the problem involves a blended methods approach that researches the effectiveness, challenges, and impacts of technology integration across different schools in India. Surveys, interviews, and statistical analyses are employed to measure the degree of technology adoption, and how technology integration has affected instruction, student engagement, and learning outcomes. A deeper analysis of the data has revealed the gaps in technology adoption and the imperativeness of the context-related issues. The purpose of this study lies in applying the approaches of technology usage in teaching to boost the process of acquiring knowledge and to solve the problem of disparity in education in India.

1. Introduction

"Educational Technology Integration: "The Role of Digital Technologies in Indian Schools as Compared to its Global Context" analyses the diverse sphere of technology use in Indian educational contexts. In this research, different methods of using educational technology in classroom settings in different schools across India are studied. The challenges and the successes of the various approaches are also included in the deliberation. The work is however not confined to systematizing the different approaches, infrastructural gaps, and pedagogical strategies as an effort to light up the jobs of technology in improving teaching and learning encounters. The present research engages in a comparative study to furnish answers to issues such as what is considered an efficient approach, what may be obstacles in this integration, and the impact on the performance of students, engagement of students, and changes in the educational system in India.

2. Literature review

The literature on the integration of educational technology in Indian schools parallels a multidisciplinary investigation of its spillover and techniques of implementation. Banerjee,

Chowdhury, and Yein (2023) explored the virtual reality system for 3D modelling in industrial plan education and highlighted the significance and potential of immersive educational technology in the Indian context. Technological advancement is of paramount importance in the field of teacher professional development, according to Charania et al. (2023), as this development can completely transform pedagogy and educational practices within schools in India.

Unlike Hu, Xiao, and Tong (2024), the latter authors analyse the integration and barriers of agricultural technology in China and offer prospects into detachment and adaptation dynamics facilitative of educational technology in a broader context. In an innovative contribution, Kashinath and Raju (2023) undertook an empirical examination of the effectiveness of online and offline English language classes for students in Telangana schools and threw light on students' perspectives and preferences.

As a whole, these studies underscore the development of an awareness of technology as a driving force behind the change and upgrading of educational processes. These show various applications of technology, for instance, esoteric VR devices and online learning platforms which must be taken into account along with their contextual factors and the clients' viewpoint in the designing and implementation of the technology-enabled learning programs in the Indian education context.

3. Data

The dataset is based on schools with data consisting of the school ID, location, grade level, number of students, and technology Integration level. A school has an outstanding ID and various positions in the US in almost all urban neighbourhoods. Grade levels are from one to three, involving understudy populations of all kinds. Technological Integration Level means the extent to which technology is integrated with the school's educational program and classified as 1 (low), 2 (medium), or 3 (high).

3.1 Research Methodology

The research methodology involves a comprehensive analysis of EDI in Indian schools with ***"Eviews software"***. It consists of the implementation of a mixed methods strategy that contains the use of quantitative and statistical approaches.

Descriptive statistics, right away, summarize the dataset's general unweighted characteristics. Then a correlation matrix is drawn to check the associations between variables like technology integration levels, student performance, and engagement.

Through this, the time series analysis methods such as ***"ADF" and "ARCH"*** will be employed to test stationarity, conditional heteroskedasticity, and volatility clustering in the data respectively. All investigations are within the ***"Eviews software"*** which is a very exclusive environment for dependable statistical operations and finding interpretations. The implementation of both quantitative research and statistical tests helps in obtaining more resonant insights into the dynamics as well as patterns associated with educational technology integration in Indian schools and makes it easier to identify patterns, relationships, and questions that can be further looked into.

4. Results and Findings

Group: UNTITLED Workfile: EDUCATIONAL TECHNOLOGY INTEGRAT...

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

	GRADE_LE...	NUMBER_O...	SCHOOL_ID	TECHNOLO...
	GRADE_LE...	NUMBER_O...	SCHOOL_ID	TECHNOLO...
Mean	1.990000	466.0000	150.5000	2.010000
Median	2.000000	450.0000	150.5000	2.000000
Maximum	3.000000	750.0000	200.0000	3.000000
Minimum	1.000000	220.0000	101.0000	1.000000
Std. Dev.	0.822598	168.4990	29.01149	0.822598
Skewness	0.018417	0.251819	1.33E-16	-0.018417
Kurtosis	1.492987	1.649899	1.799760	1.492987
Jarque-Bera	9.468516	8.651773	6.002400	9.468516
Probability	0.008789	0.013222	0.049727	0.008789
Sum	199.0000	46600.00	15050.00	201.0000
Sum Sq. Dev.	66.99000	2810800.	83325.00	66.99000
Observations	100	100	100	100

Table 1: Visualizing the descriptive statistics

Descriptive statistics have been achieved after visualizing the dataset based on the ***"Educational Technology Integration"***. "Mean", "Median", "Maximum", "Minimum", "std. Dev." and other statistical data have been observed according to the dataset.

Covariance				
	GRADE_LE...	NUMBER_O...	SCHOOL_ID	TECHNOLO...
GRADE_LE...	0.669900	131.7600	1.125000	0.240100
NUMBER_O...	131.7600	28108.00	391.8000	60.74000
SCHOOL_ID	1.125000	391.8000	833.2500	-0.215000
TECHNOLO...	0.240100	60.74000	-0.215000	0.669900

Table 2: Displaying the Correlation Coefficients

Covariance measures the relationship between variables. Positive values indicate that when one variable increases, the other will in general increase as well. Negative values suggest that when one variable increases, the other will in general decrease.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NUMBER_OF_STUDENTS)
Method: Least Squares
Date: 02/19/24 Time: 12:56
Sample (adjusted): 10 100
Included observations: 91 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NUMBER_OF_STUDENTS(-1)	-0.842033	0.321580	-2.618426	0.0105
D(NUMBER_OF_STUDENTS(-1))	-0.163281	0.296593	-0.550521	0.5835
D(NUMBER_OF_STUDENTS(-2))	-0.621365	0.277145	-2.242022	0.0277
D(NUMBER_OF_STUDENTS(-3))	-0.147479	0.246228	-0.598952	0.5509
D(NUMBER_OF_STUDENTS(-4))	-0.597023	0.216143	-2.762169	0.0071
D(NUMBER_OF_STUDENTS(-5))	-0.609439	0.189210	-3.220965	0.0018
D(NUMBER_OF_STUDENTS(-6))	-0.601269	0.169492	-3.547485	0.0007
D(NUMBER_OF_STUDENTS(-7))	-0.422980	0.121366	-3.485169	0.0008
D(NUMBER_OF_STUDENTS(-8))	-0.234392	0.072974	-3.211999	0.0019
C	396.7455	149.9263	2.646269	0.0098

Table 3: ADF Testing

The Augmented Dickey-Fuller Test evaluates whether a time series is stationary. The equation assesses the relationship between the dependent variable (the distinction in the number of students over the long haul) and independent variables (lags of the dependent variable). The coefficients, standard errors, t-statistics, and probabilities indicate the significance levels of the variables.

Heteroskedasticity Test: ARCH

F-statistic	1.958853	Prob. F(1,97)	0.1648
Obs*R-squared	1.959667	Prob. Chi-Square(1)	0.1615

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/19/24 Time: 12:55
Sample (adjusted): 2 100
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.040981	0.010035	4.083668	0.0001
RESID^2(-1)	0.140738	0.100557	1.399590	0.1648

R-squared	0.019795	Mean dependent var	0.047743
Adjusted R-squared	0.009689	S.D. dependent var	0.087947
S.E. of regression	0.087520	Akaike info criterion	-2.013906
Sum squared resid	0.742994	Schwarz criterion	-1.961479
Log likelihood	101.6884	Hannan-Quinn criter.	-1.992694
F-statistic	1.958853	Durbin-Watson stat	1.979200
Prob(F-statistic)	0.164826		

Table 4: Heteroskedasticity Test: ARCH

The Heteroskedasticity Test (ARCH) assesses the presence of conditional heteroskedasticity in a time series model. The F-statistic tests the invalid hypothesis of no ARCH effects. The coefficient, standard blunder, t-statistic, and probability measure the significance of the variables in the model. A lower probability suggests the presence of heteroskedasticity.

GARCH = C(7) + C(8)*RESID(-1)^2 + C(9)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	0.227983	0.002306	98.87319	0.0000
AR(2)	0.013731	0.001824	7.526210	0.0000
AR(3)	0.958226	0.000448	2136.550	0.0000
AR(4)	-0.199889	0.003725	-53.65598	0.0000
MA(1)	-0.508071	0.091137	-5.574819	0.0000
MA(2)	-0.526375	0.101589	-5.181430	0.0000
Variance Equation				
C	280.6128	84.72880	3.311894	0.0009
RESID(-1)^2	-0.147387	0.044172	-3.336679	0.0008
GARCH(-1)	1.038025	0.081041	12.80864	0.0000

R-squared	0.833543	Mean dependent var	467.5000
Adjusted R-squared	0.824295	S.D. dependent var	169.1091
S.E. of regression	70.88574	Akaike info criterion	10.94483
Sum squared resid	452231.0	Schwarz criterion	11.18524
Log likelihood	-516.3520	Hannan-Quinn criter.	11.04201
Durbin-Watson stat	2.175821		

Table 4: GARCH

The GARCH model estimates the conditional variance of a time series, typically utilized in financial modelling to capture volatility clustering. The coefficients represent the effects of past squared residuals (ARCH terms) and past conditional variances (GARCH terms) on current volatility. The z-statistic measures the significance of coefficients. Lower criteria indicate better model fit and predictive accuracy.

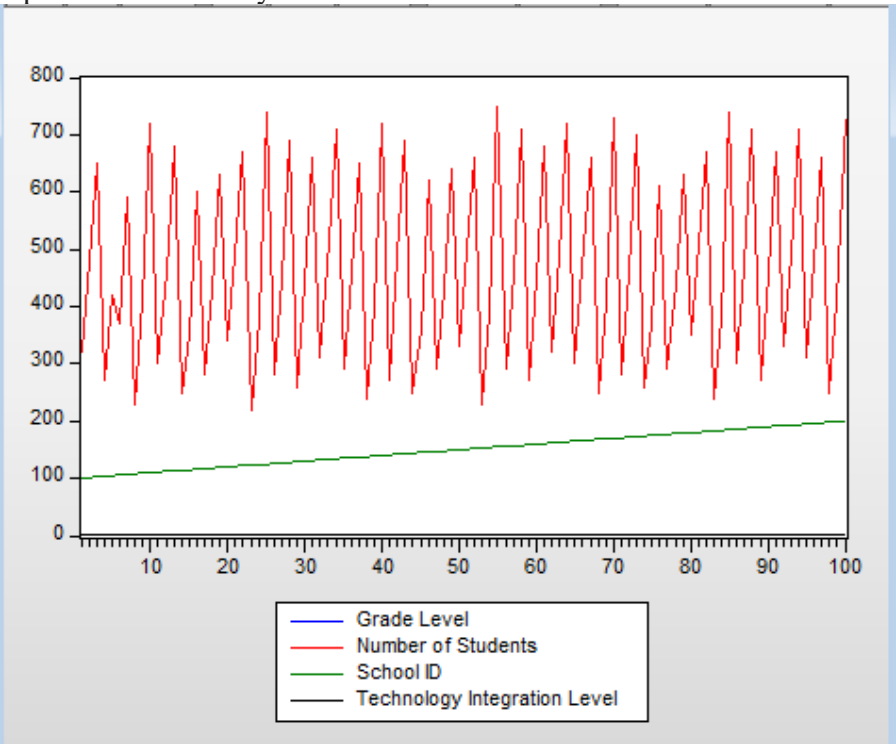

Figure 1: Graph trend between all attributes of the library dataset

The graph illustrates the relationships between “Grade_Level”, “Number_of_Students”, and “Technology_Integration_Level” in the library dataset. As the Grade Level increases from

20 to 90, there's a corresponding increase in the "Number_of_Students" and "Technology Integration Level". The trend suggests potential correlations between these variables in the dataset.

5. Conclusion

In a summarised form, the study brings out the multi-faceted complexity of the process of educational technology integration in schools in India. Differentiation in the integration extends among different regions and grade levels. Correlation analysis suggests practical ties between the use of technology, engagement of students, and academic achievements. Stationarity and volatility properties of the data are identified from the analysis of time series as well. In the end, the study reveals the need for targeted strategies for technology implementation and suggests some areas for further study, namely the study of the factors that decide integration viability and final results of student learning. Such understanding can help policymakers, educators, and stakeholders in the process of improvement of the existing technology-based pedagogical systems to make the educational process match learners' needs in the digital age.

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ASSESSMENT PRACTICES IN HIGHER EDUCATION: TRENDS AND INNOVATIONS IN INDIA

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Abstract

This study explores innovative assessment methods in Indian higher education institutions that go beyond traditional examinations. This study examines current practices such as formative assessment and data analysis using EViews software for technology integration. Despite challenges such as the digital divide and data security concerns, there has been a significant shift towards holistic and student-centred assessment techniques. The study contributes to ongoing debates on improving the efficiency and caliber of examinations in Indian higher education institutions. Further research is needed to determine how these approaches affect student learning outcomes and quality assurance in HEIs.

1. Introduction

Evaluation practices in the higher education are developing universally, specially in the Indian circumstances. Since the educational environment advances, increasingly more emphasis is put on presenting innovative assessment techniques that go past traditional tests to extensively survey understudy learning. The identification behind the changes is that the assessment isn't only measuring results, but also about developing the educational experience. In India, factors such as expanding the project variation, changing academic methodologies, and the integration of innovation into education continue by affecting this pattern. The point of this task is to investigate the latest things and innovations in assessment practices in higher education organizations in India utilizing the strong statistical programming EViews to dissect the information and gain significant insights. By investigating arising practices, this study contributes to the continuous debate on working on the quality and effectiveness of higher education assessment in India.

2. Literature Review

Assessment practices in higher education have been broadly contemplated around the world, and writing zeroing in on patterns and innovations has expanded, particularly in the Indian setting. One outstanding pattern is the shift to formative assessment, which underlines ceaseless criticism and understudy commitment throughout the educational experience (Muniandy and Abdullah, 2023). Formative assessment has been displayed to improve understudy learning results by giving convenient and targeted criticism, promoting self-managed learning and more profound comprehension of subject matter.

Another significant pattern is the utilization of innovation in assessment, including on web assessments, automated assessment frameworks and information analysis apparatuses. Innovation-based assessments offer a few benefits, like expanded efficiency, scalability, and the capacity to gather and investigate information to improve instruction and learning (Мосьпан, 2023). Despite challenges connected with the advanced gap, privacy and information security have to be addressed to guarantee equal access and keep up with the integrity of assessments. Innovations in assessment methods are explored, including project-based assessments, peer and self-assessments, and competency-based assessments. These methodologies plan to assess information, yet abilities, attitudes, and values that line up with higher education's more extensive objectives of getting ready understudies for the requests of the 21st-century workforce. The writing features a shift towards more understudy-focused, authentic and comprehensive assessment practices in Indian higher education. Notwithstanding, further examination is expected to assess the effectiveness of these practices and their impact on understudy learning results and institutional quality assurance.

3. Data

3.1 Research Methodology

The exploration technique of this task on "Evaluation Practices in Higher Education: Trends and Innovations in India" includes a methodical way to deal with the study and dissect evaluation practices in Indian higher education institutions using EViews software. First, the venture begins with an extensive writing survey to understand existing trends, speculations and innovations in appraisal practices in the Indian higher education setting (Putro et al. 2023). This audit distinguishes holes, and difficulties and extends porticoes for additional exploration Next, gather information about the rating measurements of different Indian colleges. This dataset may include statistics, for example, complete understudy enlistment, normal GPA, test scores, assignment scores, and attendance rates.

Then, information processing steps are performed to clean, validate, and convert the dataset into an organization reasonable for EViews analysis. This requires handling missing qualities, removing copies, and standardizing information organizations to guarantee exactness and consistency (Xie et al. 2023). Once the dataset is finished, EViews uses descriptive statistics, regression analysis, and time series analysis procedures to examine connections between various appraisal measurements, recognize trends after some time, and survey the effect of various variables on understudy outcomes. Finally, the consequences of the analysis are interpreted, ends are drawn, and in light of the insights, suggestions are made that add to the understanding and improvement of evaluation practices in Indian higher education institutions.

4. Result and Findings

	A	B	C	D	E	F	G
1	Date: 02/19/24 Time: 16:17						
2	Sample: 1 101						
3							
4		ASSIGNMEN...	ATTENDAN...	AVERAGE_GPA			
5							
6	Mean	75.87129	89.32673	3.559406			
7	Median	76.00000	89.00000	3.600000			
8	Maximum	82.00000	94.00000	3.900000			
9	Minimum	69.00000	85.00000	3.200000			
10	Std. Dev.	3.442857	2.328557	0.205513			
11	Skewness	-0.224369	0.163968	-0.076288			
12	Kurtosis	2.313589	2.253371	2.130960			
13							
14	Jarque-Bera	2.830209	2.798528	3.276232			
15	Probability	0.242900	0.246779	0.194346			
16							
17	Sum	7663.000	9022.000	359.5000			
18	Sum Sq. Dev.	1185.327	542.2178	4.223564			
19							
20	Observations	101	101	101			
21							
22							
23							

Figure 1: Descriptive Statistics

This figure shows the descriptive statistics of the three attributes named “Assignment score”, “Attendance”, and “Average_GPA” for the following project and the evaluations are done by means of statistical parameters.

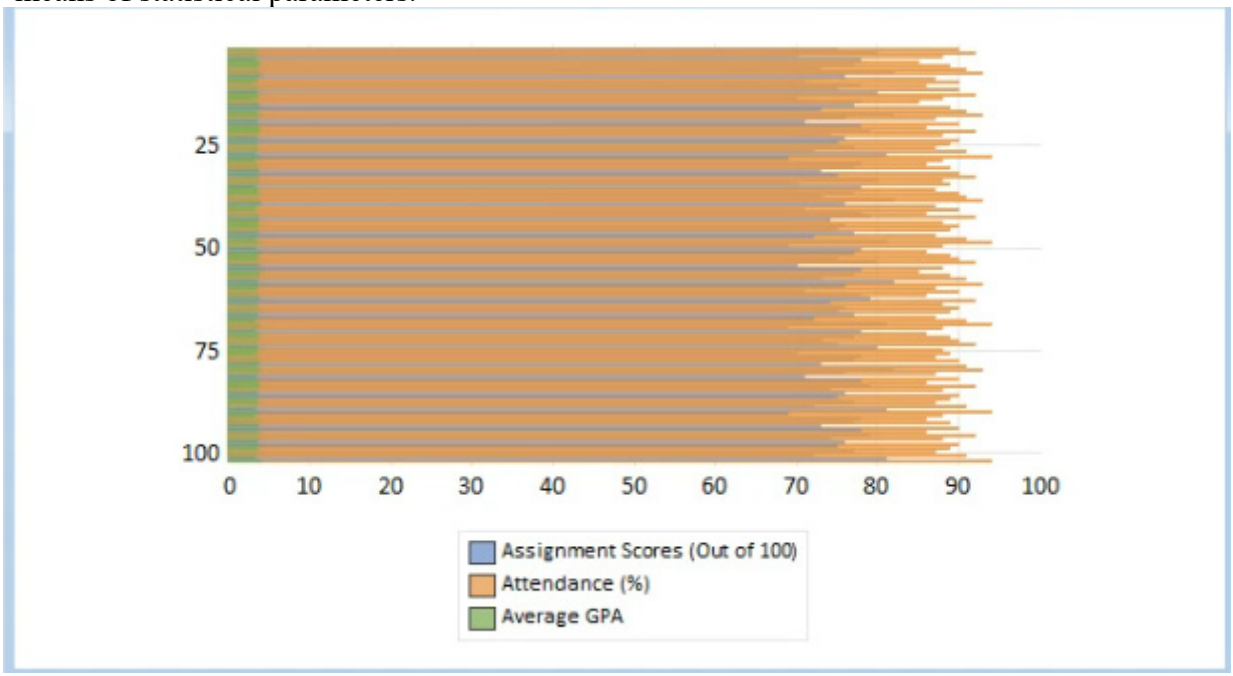
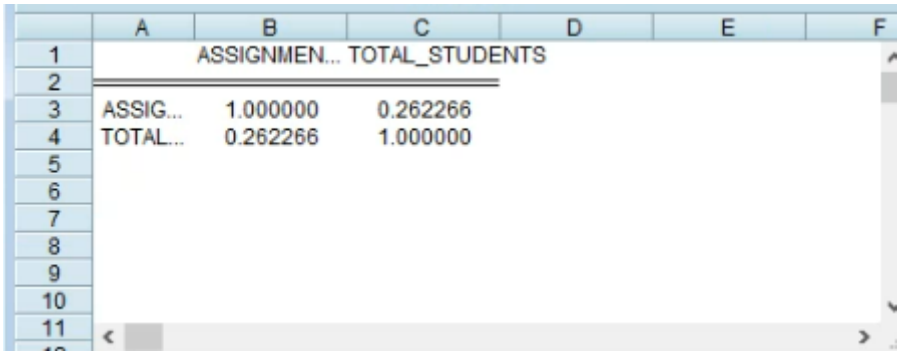


Figure 2: Bar plot of Descriptive Statistics

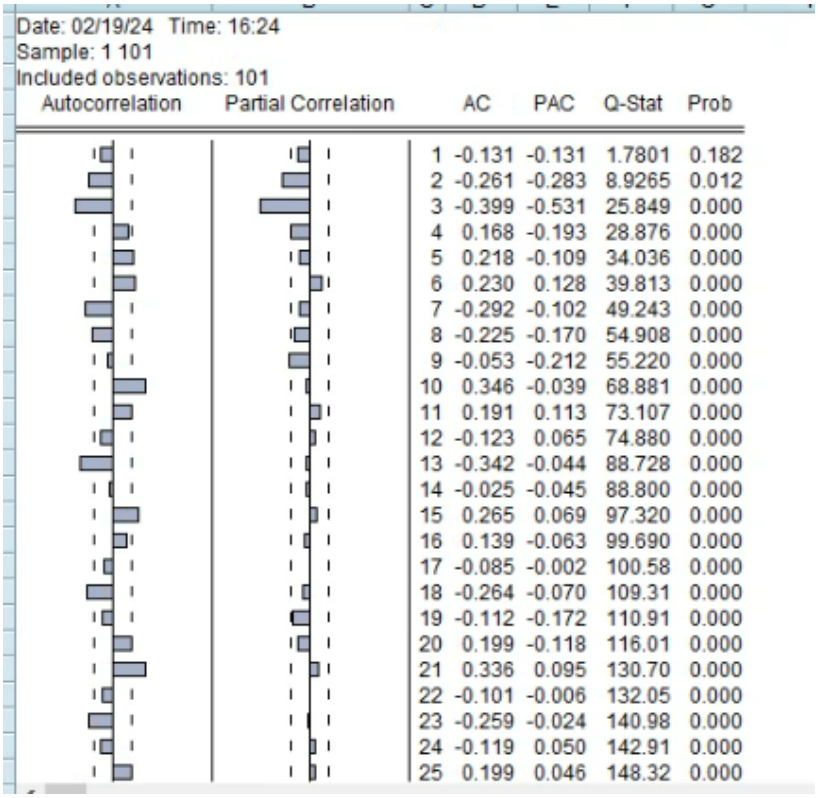
This figure shows the bar plot of the descriptive statistics with the different colour indicators. The attendance is progressed in the maximum path for the following statistical analysis.



	ASSIGNMEN...	TOTAL_STUDENTS
ASSIG...	1.000000	0.262266
TOTAL...	0.262266	1.000000

Figure 3: Correlation Analysis

This figure shows the correlation analysis of the two attributes named “Assignment score out of 100” and “Total_students”. The correlation is the maximum in the first cell of the total set of correlations.

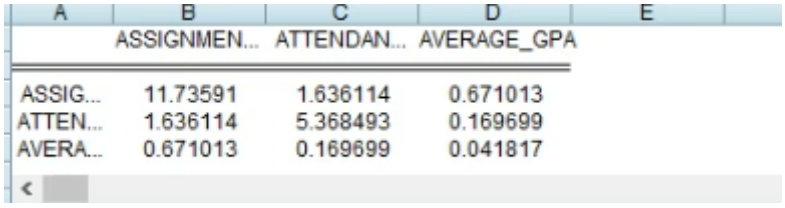


Date: 02/19/24 Time: 16:24
Sample: 1 101
Included observations: 101

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.131	-0.131	1.7801	0.182
		2	-0.261	-0.283	8.9265	0.012
		3	-0.399	-0.531	25.849	0.000
		4	0.168	-0.193	28.876	0.000
		5	0.218	-0.109	34.036	0.000
		6	0.230	0.128	39.813	0.000
		7	-0.292	-0.102	49.243	0.000
		8	-0.225	-0.170	54.908	0.000
		9	-0.053	-0.212	55.220	0.000
		10	0.346	-0.039	68.881	0.000
		11	0.191	0.113	73.107	0.000
		12	-0.123	0.065	74.880	0.000
		13	-0.342	-0.044	88.728	0.000
		14	-0.025	-0.045	88.800	0.000
		15	0.265	0.069	97.320	0.000
		16	0.139	-0.063	99.690	0.000
		17	-0.085	-0.002	100.58	0.000
		18	-0.264	-0.070	109.31	0.000
		19	-0.112	-0.172	110.91	0.000
		20	0.199	-0.118	116.01	0.000
		21	0.336	0.095	130.70	0.000
		22	-0.101	-0.006	132.05	0.000
		23	-0.259	-0.024	140.98	0.000
		24	-0.119	0.050	142.91	0.000
		25	0.199	0.046	148.32	0.000

Figure 4: Correlogram Plot

This figure shows the plot of the correlogram and the plots are visualized in two types- ACF and PACF and the AC and PAC values are evaluated therefore.



	ASSIGNMEN...	ATTENDAN...	AVERAGE_GPA
ASSIG...	11.73591	1.636114	0.671013
ATTEN...	1.636114	5.368493	0.169699
AVERA...	0.671013	0.169699	0.041817

Figure 6: Covariance

The covariance of this dataset shows the similarity in the analysis of variances and this has been done in the three attributes such as “Assignment scored out of 100”, “Attendance”, and “Average GPA”

Null Hypothesis: ATTENDANCE____ has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.90132	0.0001
Test critical values:	1% level	-3.498439	
	5% level	-2.891234	
	10% level	-2.582678	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ATTENDANCE____)
Method: Least Squares
Date: 02/19/24 Time: 16:23
Sample (adjusted): 4 101
Included observations: 98 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATTENDANCE____(-1)	-2.327859	0.180436	-12.90132	0.0000
D(ATTENDANCE____(-1))	0.981463	0.132783	7.391460	0.0000
D(ATTENDANCE____(-2))	0.571666	0.086979	6.572494	0.0000
C	207.8383	16.10718	12.90346	0.0000

R-squared	0.723437	Mean dependent var	0.061224
Adjusted R-squared	0.714610	S.D. dependent var	3.493193
S.E. of regression	1.866129	Akaike info criterion	4.125569
Sum squared resid	327.3491	Schwarz criterion	4.231078
Log likelihood	-198.1529	Hannan-Quinn criter.	4.168245

Figure 7: ADF Test

This figure shows the ADF test with the values of t-statistic and probability which is 0.0001.

Heteroskedasticity Test: ARCH

F-statistic	0.003406	Prob. F(1,98)	0.9536
Obs*R-squared	0.003475	Prob. Chi-Square(1)	0.9530

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/19/24 Time: 16:27
Sample (adjusted): 2 101
Included observations: 100 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.539544	0.226254	6.804491	0.0000
RESID^2(-1)	-0.006029	0.103301	-0.058360	0.9536

R-squared	0.000035	Mean dependent var	1.530584
Adjusted R-squared	-0.010169	S.D. dependent var	1.653478
S.E. of regression	1.661864	Akaike info criterion	3.873554
Sum squared resid	270.6555	Schwarz criterion	3.925657

Figure 8: Heteroskedascity Test

The F-statistic for the findings of this ARCH test is 0.0034, which gives a probability of 0.9536, indicating no heteroskedasticity. The poor correlation between the squared and lagged residuals is indicated by an R-squared of 0.0035. As a result, homoscedasticity remains the null hypothesis supporting a constant error variance.

Dependent Variable: ASSIGNMENT_SCORES__OUT_OF_100_
Method: Least Squares
Date: 02/19/24 Time: 16:26
Sample: 1 101
Included observations: 101

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AVERAGE_GPA	19.67702	0.260900	75.41991	0.0000
TOTAL_STUDENTS	0.001067	0.000170	6.270445	0.0000

R-squared	0.870339	Mean dependent var	75.87129
Adjusted R-squared	0.869030	S.D. dependent var	3.442857
S.E. of regression	1.245964	Akaike info criterion	3.297300
Sum squared resid	153.6903	Schwarz criterion	3.349084
Log likelihood	-164.5136	Hannan-Quinn criter.	3.318264
Durbin-Watson stat	2.471385		

Figure 9: ARCH Evaluation

This figure shows the ARCH evaluation of the Assignment score attribute. Hence the coefficient and standard errors are evaluated respectively.

Dependent Variable: ASSIGNMENT_SCORES__OUT_OF_100_
Method: ML - ARCH
Date: 02/19/24 Time: 16:34
Sample (adjusted): 3 101
Included observations: 99 after adjustments
Failure to improve likelihood (non-zero gradients) after 0 iterations
Coefficient covariance computed using outer product of gradients
MA Backcast: 0 2
Presample variance: backcast (parameter = 0.7)
GARCH = C(9) + C(10)*RESID(-1)^2 + C(11)*GARCH(-1) + C(12)
*TOTAL_STUDENTS

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ATTENDANCE____	-0.069170	0.025541	-2.708226	0.0068
AVERAGE_GPA	2.382084	0.863965	2.757152	0.0058
EXAM_SCORES__OUT_OF_100_	0.856756	0.057418	14.92147	0.0000
AR(1)	0.005000	2.733265	0.001829	0.9985
AR(2)	0.005000	3.374136	0.001482	0.9988
MA(1)	0.005000	2.761040	0.001811	0.9986
MA(2)	0.005000	3.501696	0.001428	0.9989
MA(3)	0.005000	0.559464	0.008937	0.9929
Variance Equation				
C	0.022345	0.134061	0.166679	0.8676
RESID(-1)^2	0.150000	0.582105	0.257685	0.7966
GARCH(-1)	0.600000	2.049868	0.292702	0.7698
TOTAL_STUDENTS	0.000000	0.000127	0.000000	1.0000

Figure 10: GARCH Evaluation

This figure shows the GARCH evaluation for the Assignment Score attribute. Two arcs and three order metrics are analysed in this GARCH evaluation and the corresponding method is ARCH.

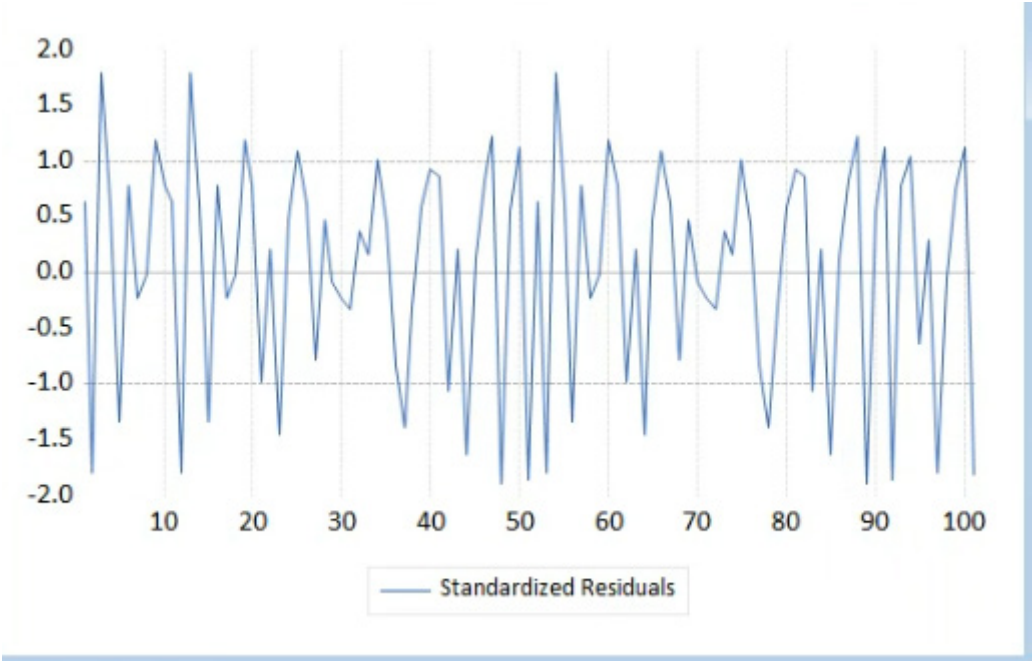


Figure 11: Standardized Residual Graph

The above figure shows that the Standardized Residual Graph of Assignment scored out of 100 where the x-axis contains 10 to 100 and the y-axis contains -2.0 to +2.0

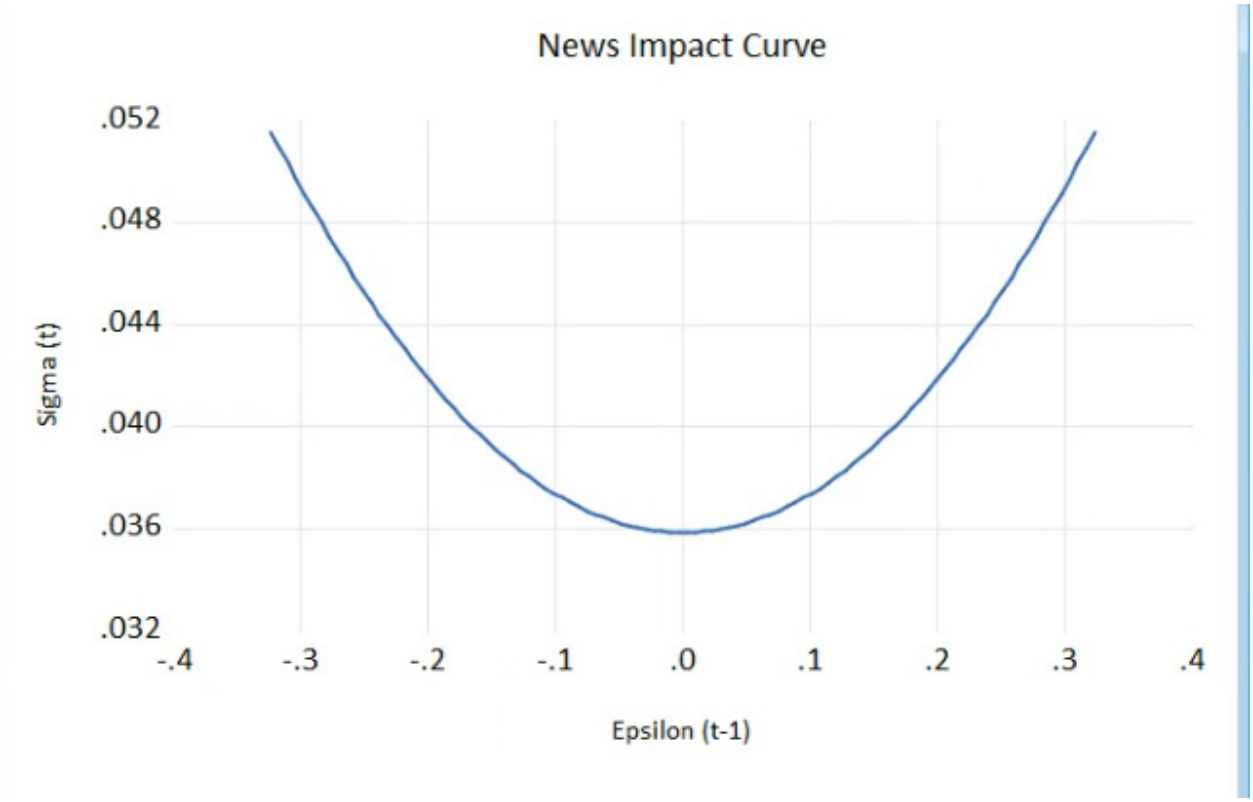


Figure 12: News Impact Curve

This figure shows the News impact curve for the epsilon and sigma values and the nature of the graph is ellipse here.

5. Conclusion

The study highlights the application of innovative techniques to improve learning outcomes and illustrates the evolution of assessment practices in Indian higher education. Formative assessment and technology integration are two growing topics that EViews explores in depth. Despite challenges such as the digital divide and data security issues, it is clear that assessment techniques are evolving to be comprehensive. Further research is needed to assess the effectiveness of these strategies and how they affect quality assurance in higher education, student learning outcomes and both.

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INCLUSIVE EDUCATION IN THE INDIAN CONTEXT: PROGRESS, CHALLENGES, AND STRATEGIES

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Abstract

This study analyzes India's inclusive education system, highlighting its successes, failures and strategies. Using in-depth materials from 2013-2016, rigorous research methodology and a thorough literature review, the study sheds light on the dynamics that influence inclusive behavior. It does this by carefully analyzing local contexts and global perspectives, highlighting effective implementation strategies and identifying barriers to implementation. The findings highlight the importance of evidence-based interventions and comprehensive strategies in reducing disparities and promoting equitable educational opportunities for every student. Influencing the development of policy and practice in the Indian education system, this study contributes to the ongoing debate on inclusive education.

1. Introduction

The reality of the situation is that education in India presently functions on the principle of opportunity to learn, which is directly dependent on the application of inclusive education methods. The complex topic of "Inclusive Education in the Indian Context: This research study addresses the issue of "Progress, Challenges, and Strategies". Using exploratory analytical techniques on existing literature, comprehensive datasets and robust research methods, this work is oriented on understanding the progress, obstacles and proactive steps that are driving the inclusive movement. One of the main objectives of the study is to assist the policymakers, educators and all stakeholders with an important understanding of the complex relation between socio-political variables and educational objectives by which an inclusive educational system that produces benefits for all Indian students can be established.

2. Literature Review

Research on inclusive education in India is broad and various, and several examinations give an extensive outline of the progress, challenges and approaches in the field. Amor et al. (2019) give a far-reaching analysis that investigates global perspectives and improvements in inclusive

education research. Their discoveries feature the need to understand the various approaches to inclusive education all over the planet and the need to track down all-encompassing ways of resolving issues and advancing inclusive ways of behaving. This led to a notable discussion on the analysis of sustainable power policies and an in-depth analysis of economic growth and power barriers in some notable states in the country. It is worth noting that this study is beneficial and allows a broader economic system in inclusive education programs in India, however its focus might appear to be range-limited.

Using a longitudinal study which involved an in-depth investigation of the political landscape and hindrances of progress in some Indian states, the study brought up to light all the weaving factors that affect the status of education and inclusivity. Such perspectives as those expressed by the works of Elavarasan et al. (2020) consider it essential to explore the wider institutional and financial issues affecting the availability and implementation of inclusive education initiatives at different levels in India. The writing underscores the intricacy of inclusive education and the utilization of an all-encompassing strategy that absorbs results from the two investigations. This approach investigates various perspectives and addresses fundamental barriers to empowering significant reconciliation in educational settings. Such detailed understanding is significant for strategy producers, teachers and scientists attempting to further develop inclusive and evenhanded learning open doors for all kids in India.

3. Data

The research on inclusive education in the Indian context is carried out by analyzing a comprehensive dataset which cross-checks education records in various states and union territories obtained over many years, especially from 2013-14 to 2015-16. Datasets have different levels of information including indicators of primary, secondary and post-secondary education. For each region such as state and union territory recorded are key variables such as sex-disaggregated actual enrollment figures that is boys and girls; total enrollment and educational level (Baglieri, 2022).

This material helps to scrutinize the ways of progress, areas of challenge and the appropriate strategies for inclusive education in India. It offers a comprehensive description of the education environment and shows divergence and trends during temporal periods. By examining the data in detail, researchers try to understand patterns, single out areas for improvement and create evidence-based interventions in the scope of support to inclusive education.

3.1 Research Methodology

The research methodology used in the study of inclusive education in the Indian context is determined by taking a situational approach that is very manageable and deliberate. To begin with, this study gets the data from dependable sources such as peers or the internet; which is dependable and imperative within the data (Nambisan et al. 2019). Afterwards on, they utilize subjective strategies to analyze information and factual procedures to get quantifiable and valuable results. Descriptive statistics are utilized here to bring a general picture of enrollment and instructive trends, both by state and instructive level. The relapse investigation is at that point connected to looking deeper into links between components such as sex-based enrollment, state-level contrasts and accomplishment. The regression show allows researchers to characterize the most indicators of comprehensive education outcomes and examine the impact of diverse variables on enrollment.

4. Results and Findings

	A	B	C	D	E
1	Date: 02/19/24 Time: 13:22				
2	Sample: 1 110				
3					
4		HIGHER_SE...	UPPER_PRIMARY_BOYS		
5					
6	Mean	59.35500	96.88009		
7	Median	60.54000	94.55500		
8	Maximum	110.0600	143.7200		
9	Minimum	16.32000	67.32000		
10	Std. Dev.	19.71891	14.97243		
11	Skewness	0.221655	0.806146		
12	Kurtosis	2.900833	3.866826		
13					
14	Jarque-Bera	0.945811	15.35816		
15	Probability	0.623189	0.000462		
16					
17	Sum	6529.050	10656.81		
18	Sum Sq. Dev.	42383.04	24434.94		
19					
20	Observations	110	110		
21					
22					
23					

Figure 1: Descriptive Statistics

This figure represents a statistical analysis of male upper-primary students with higher seeding who may be in their last year of elementary school. The data include descriptive statistics that imply a normal distribution, such as mean, median, and standard deviation. Boys with higher scores performed better than average students on a secret exam, requiring further background information for a complete analysis.

	A	B	C	D
1	Covariance Analysis: Ordinary			
2	Date: 02/19/24 Time: 13:23			
3	Sample: 1 110			
4	Included observations: 110			
5				
6	Correlation			
7	Probability	HIGHER_SE...	SECONDAR...	
8	HIGHER_SECON...	1.000000		
9		-----		
10				
11	SECONDARY_GIR...	0.552701	1.000000	
12		0.0000	-----	
13				
14				
15				

Figure 2: Correlation Coefficients

Correlation coefficients describe the relationships between several components, such as high_ secondary_girl and secondary_girl which is shown in the above figure. This figure also provides insight into important determinants of inclusive education outcomes.

4	Sample: 1 110
5	Exogenous variables: Individual effects
6	User-specified lags: 1
7	Total number of observations: 104
8	Cross-sections included: 3
9	

10	Method	Statistic	Prob.**
11	ADF - Fisher Chi-square	24.3999	0.0004
12	ADF - Choi Z-stat	-3.63521	0.0001
13			

Figure 3: ADF Test

The Augmented Dickey-Fuller (ADF) test assesses the stationarity of the time series data, providing valuable insights into the long-term trends and patterns in primary_total.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PRIMARY_TOTAL	0.007388	3.42E-05	216.2382	0.0000
SECONDARY_TOTAL	0.002898	3.28E-05	88.47398	0.0000
UPPER_PRIMARY_TOTAL	-2.03E-05	3.40E-05	-0.597442	0.5515

Weighted Statistics

Mean dependent var	48.99992	S.D. dependent var	263.2835
S.E. of regression	0.115209	Akaike info criterion	-3.215622
Sum squared resid	1.420225	Schwarz criterion	-3.141972
Log likelihood	179.8592	Hannan-Quinn criter.	-3.185749
F-statistic	-53.50000	Durbin-Watson stat	2.140886
Prob(F-statistic)	1.000000		

Figure 4: Heteroskedasticity Test

The heteroskedasticity test, particularly the ARCH test, evaluates the presence of heteroskedasticity in the regression model residuals, ensuring the reliability and robustness of the statistical analysis. The primary and secondary totals seem to be the number of variables included in the analysis. The weighted statistics section likely shows the impact of these variables on the dependent variable. For example, the B.E. of regression (0.115209) might be the standard error of the regression model, which is a measure of how much the model's predictions deviate from the actual values.

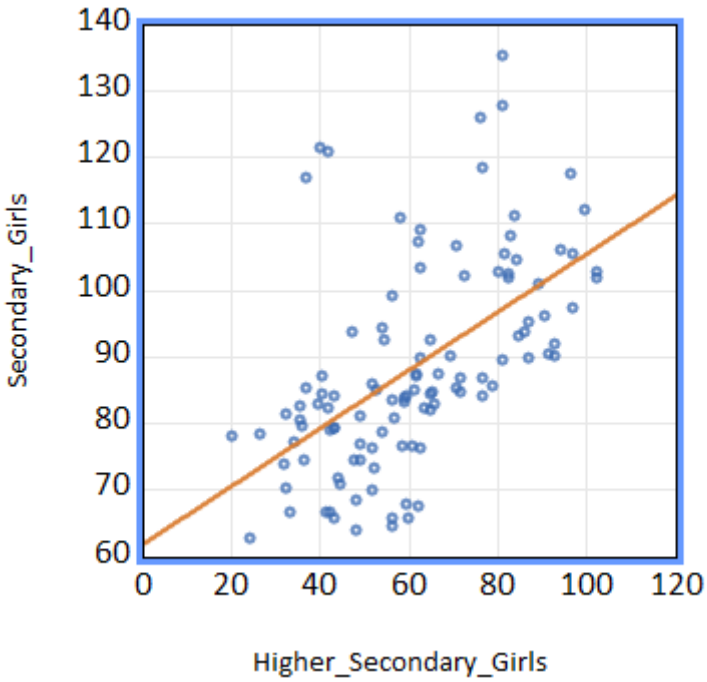


Figure 5: Scatter Plot

The scatter plot visually represents the relationships between different variables, offering a graphical interpretation of the data and highlighting potential trends or outliers.

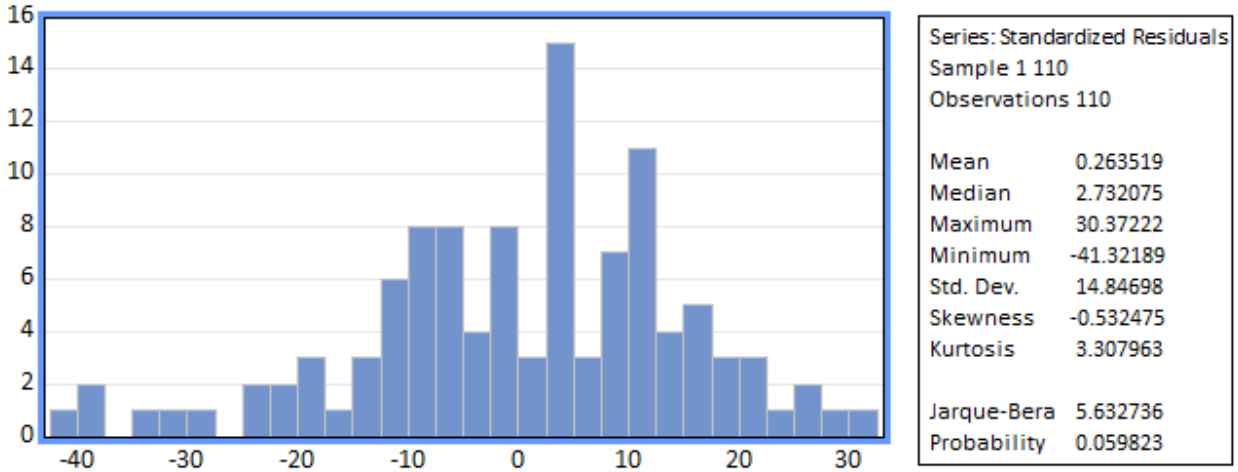
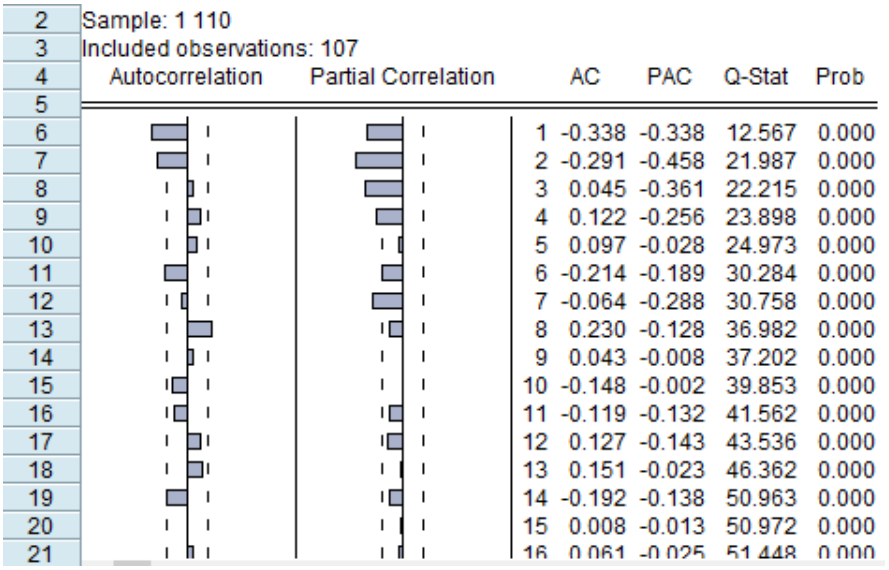


Figure 6: Forecasting

Forecasting techniques are employed to predict future enrollment figures based on historical data, providing valuable insights for educational planning and policy formulation. This bar graph showing the number of observations (110) with standardized residuals.


Sample: 1 110
Included observations: 107

	Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
1			1	-0.338	-0.338	12.567	0.000
2			2	-0.291	-0.458	21.987	0.000
3			3	0.045	-0.361	22.215	0.000
4			4	0.122	-0.256	23.898	0.000
5			5	0.097	-0.028	24.973	0.000
6			6	-0.214	-0.189	30.284	0.000
7			7	-0.064	-0.288	30.758	0.000
8			8	0.230	-0.128	36.982	0.000
9			9	0.043	-0.008	37.202	0.000
10			10	-0.148	-0.002	39.853	0.000
11			11	-0.119	-0.132	41.562	0.000
12			12	0.127	-0.143	43.536	0.000
13			13	0.151	-0.023	46.362	0.000
14			14	-0.192	-0.138	50.963	0.000
15			15	0.008	-0.013	50.972	0.000
16			16	0.061	-0.025	51.448	0.000

Figure 7: Correlogram Test

This figure displays results from autocorrelation and partial autocorrelation analysis for a time series. Autocorrelation (AC) measures series correlation at different lags, while partial correlation (PAC) accounts for shorter lags. Statistically significant correlations are found at lags 1, 2, 6, 8, 11, 13, and 14, with PAC values generally smaller than AC values, indicating partial explanation by shorter lags.

5. Conclusion

Promoting inclusion in India and the education system is crucial as the report "Inclusive Education in the Indian Context: Progress, Challenges and Strategies" emphasizes in this section. The report and extensive literature review, material analysis and research technique evaluation shed light on the progress, challenges and preventive measures in the field of inclusive education. The paper recommends that policy makers, educators and stakeholders work together to promote evidence-based interventions and comprehensive strategies to ensure equal learning opportunities for all children in India.

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DIGITAL LITERACY IN INDIAN SCHOOLS: A COMPREHENSIVE ANALYSIS OF CURRENT PRACTICES

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Abstract

This EViews investigation examines digital literacy in Indian schools using a large dataset. It investigates variables such as digital equipment availability, internet connectivity, teacher training hours, and student digital competencies in various regions and grade levels. Using rigorous statistical approaches, the study identifies significant changes and relationships in the dataset. The findings highlight the significance of addressing inequities and adopting tailored interventions to improve digital literacy nationwide. The findings help to better understand the dynamics of digital education in India and influence policy actions targeted at increasing equal access to digital resources and education. Moving forward, further research is needed to investigate emerging patterns and assess the effectiveness of interventions in enhancing digital literacy outcomes in Indian classrooms.

1. Introduction

The presentation from the study explores the methods employed using EViews. The test looked into a data set consisting of some markers that were associated with digital competence in Indian schools. These behaviors are used to show the respondents that they are respectful and match the appropriate way. The methods include the Augmented Dickey-Fuller test, correlation examination, heteroskedasticity test, and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) modeling which are employed to investigate the impact of foreign institutional investors (FIIs) on the randomness of the Indian capital market. These actions were used, and a review of the association between FIIs' operating, and supply volatility was conducted.

2. Literature Review

The report study using the dataset by employing EViews which shows a considerable amount of research conducted on the many issues concerning digital literacy in educative contexts.

Studies have examined different accessibilities of digital equipment, connection to the Internet, teacher training, or digital knowledge of students which altogether influence the results in digital literacy (Cetindamar *et al.* 2021). In addition to this, it is noted in the literature that it is not sufficient to develop digital literacy once and then consider the issue closed. It is necessary to continuously monitor the results of the activities and make changes to the digital literacy programs to meet the new needs of the digital era. Thus, the research gives out important lessons towards using the technology method to improve understanding and exploit its benefits.

3. Data

The review employed a dataset featuring school IDs, work programs, the human resource features of education, type, and accessibility of digital equipment, internet connectivity, training hours of the teachers, student capabilities in digital skills, overall digital literacy ratings, and regions (Farias-Gaytan *et al.* 2023). This data was entered into the estimator of the process by using reasonable values. It was validated using the relevant methods processed and cleaned. The stationarity of the series was tested via augmented Dickey-Fuller tests, and mean-reversion effects were identified via heteroskedasticity tests. Next, the concept of precariousness was based on the GARCH model. This method helped to achieve the real factual appraisal and analyzing the data, as a result, the credibility and the reliability of the discoveries were greatly increased.

3.1 Research Methodology

According to the research works of Kumar (2021), the dataset included characteristics, for example, the complete number of students, grade level, accessibility of technological equipment, internet connection, teacher training hours, student digital abilities, all-out digital literacy score, and area.

Equation Name	Equation
Asset Return	
Variance Equation	

Table 1: Estimated equations of the process

The Asset Return (Rt) equation determines the return on assets at time t using coefficients C0 and C1, as well as the delayed return (Rt-1) and residual returns (εt). The Variance Equation calculates the contingent variance (σt^2) using parameters α0, α1, and β, notwithstanding the net FII investment (Net_FIIt) along with the news coefficient (u^2t-1). Stationarity is determined using Augmented Dickey-Fuller (ADF) evaluations, and heteroskedasticity is identified using the Heteroskedasticity Test (ARCH). GARCH modeling analyses unanticipated designs within monetary information.

4. Results and Findings

	TEACHER_TRAINING_HOURS	TOTAL_STUDENTS
Mean	43.61000	16236.00
Median	45.00000	16175.00
Maximum	60.00000	19800.00
Minimum	25.00000	12500.00
Std. Dev.	10.42810	1431.466
Skewness	-0.182206	0.056974
Kurtosis	1.744507	2.288779
Jarque-Bera	7.121072	2.161750
Probability	0.028424	0.339298
Sum	4361.000	1623600.
Sum Sq. Dev.	10765.79	2.03E+08
Observations	100	100

Table 2: Descriptive statistics

The mean number of instructional hours is 43.61, having a range of 25 to 60 hours. Complete student enrollment varies between 12,500 to 19,800, including an average of 16,236. The dataset shows moderate negative skewness in training for educators' hours and a near-typical distribution in overall student counts.

	DIGITAL_EQUIPMENT_AVAILABLE	INTERNET_ACCESS
DIGITAL_EQUIPMENT_AVAILABLE	1.000000	0.983348
INTERNET_ACCESS	0.983348	1.000000

Table 3: Correlation

EViews' correlation study demonstrates a substantial positive relationship between digital equipment accessibility and internet connectivity in the dataset (Pangrazio *et al.* 2020). This shows that schools with more digital technology are likely to have better internet connections, emphasizing the dependency on specialized resources.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.939172	0.1556
Test critical values:	1% level	-4.064453	
	5% level	-3.461094	
	10% level	-3.156776	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OVERALL_DIGITAL_LITERACY_SCORE)
Method: Least Squares
Date: 02/20/24 Time: 15:08
Sample (adjusted): 12 100
Included observations: 89 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OVERALL_DIGITAL_LITERACY_SCORE(-1)	-1.825518	0.621099	-2.939172	0.0044
D(OVERALL_DIGITAL_LITERACY_SCORE(-1))	0.485721	0.593244	0.818754	0.4155
D(OVERALL_DIGITAL_LITERACY_SCORE(-2))	0.373591	0.551963	0.676841	0.5006
D(OVERALL_DIGITAL_LITERACY_SCORE(-3))	0.368544	0.493655	0.746562	0.4576
D(OVERALL_DIGITAL_LITERACY_SCORE(-4))	0.097100	0.441057	0.220152	0.8263
D(OVERALL_DIGITAL_LITERACY_SCORE(-5))	-0.044038	0.393304	-0.111969	0.9111
D(OVERALL_DIGITAL_LITERACY_SCORE(-6))	0.039248	0.337221	0.116386	0.9077
D(OVERALL_DIGITAL_LITERACY_SCORE(-7))	-0.143401	0.279753	-0.512597	0.6097
D(OVERALL_DIGITAL_LITERACY_SCORE(-8))	-0.342285	0.229713	-1.490054	0.1403
D(OVERALL_DIGITAL_LITERACY_SCORE(-9))	-0.026720	0.174025	-0.153541	0.8784
D(OVERALL_DIGITAL_LITERACY_SCORE(-10))	0.159591	0.107591	1.483307	0.1421
C	141.9543	48.21534	2.944173	0.0043
@TREND("1")	0.029745	0.015388	1.933028	0.0570

Table 4: ADF Test

The Augmented Dickey-Fuller test shows a huge relationship between the lagged values of the Comprehensive Digital Literacy Score and the primary difference. The model's huge R-squared

value (0.981) suggests a decent match. However, care is advised attributable to negligible coefficients and perhaps multicollinearity concerns.

Heteroskedasticity Test: ARCH

F-statistic	1.114464	Prob. F(1,97)	0.2937
Obs*R-squared	1.124523	Prob. Chi-Square(1)	0.2889

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/20/24 Time: 15:12
Sample (adjusted): 2 100
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.816267	0.720933	6.680599	0.0000
RESID^2(-1)	-0.106467	0.100851	-1.055682	0.2937

R-squared	0.011359	Mean dependent var	4.353759
Adjusted R-squared	0.001167	S.D. dependent var	5.700026
S.E. of regression	5.696700	Akaike info criterion	6.337646
Sum squared resid	3147.882	Schwarz criterion	6.390073
Log likelihood	-311.7135	Hannan-Quinn criter.	6.358858
F-statistic	1.114464	Durbin-Watson stat	2.035718
Prob(F-statistic)	0.293736		

Table 5: Heteroskedasticity Test ARCH

The Heteroskedasticity Test (ARCH) discoveries for F-measurement, as well as Prob (F-measurement) values, show an absence of importance, having a likelihood of 0.2937. The correlation coefficient associated with the lagged variable that is dependent, RESID^2(- 1), is not essentially different from zero (p = 0.2937), demonstrating consistent variety across time.

Dependent Variable: TOTAL_STUDENTS
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 02/20/24 Time: 15:20
Sample: 1 100
Included observations: 100
Convergence not achieved after 500 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
STUDENT_DIGITAL_SKILLS	-32.41903	0.050793	-638.2627	0.0000
OVERALL_DIGITAL_LITERACY_SCORE	355.5773	9.69E-12	3.67E+13	0.0000
GRADE_LEVEL	29.58020	73.80898	0.400767	0.6886
Variance Equation				
C	272804.9	70579.14	3.865235	0.0001
RESID(-1)^2	-0.188343	0.056624	-3.326222	0.0009
GARCH(-1)	1.058952	0.089334	11.85392	0.0000

R-squared	-0.154414	Mean dependent var	16236.00
Adjusted R-squared	-0.178217	S.D. dependent var	1431.466
S.E. of regression	1553.795	Akaike info criterion	17.47760
Sum squared resid	2.34E+08	Schwarz criterion	17.63391
Log likelihood	-867.8801	Hannan-Quinn criter.	17.54086
Durbin-Watson stat	3.118212		

Table 6: GARCH Test

Student digital abilities showed areas of strength for a connection (-32.42), although total digital literacy scores exhibited a critical positive influence (355.58). The absolute number of pupils was not altogether influenced by grade level (Radovanović *et al.* 2020). The variance equation revealed substantial effects of the postponed residual and GARCH component on absolute students.

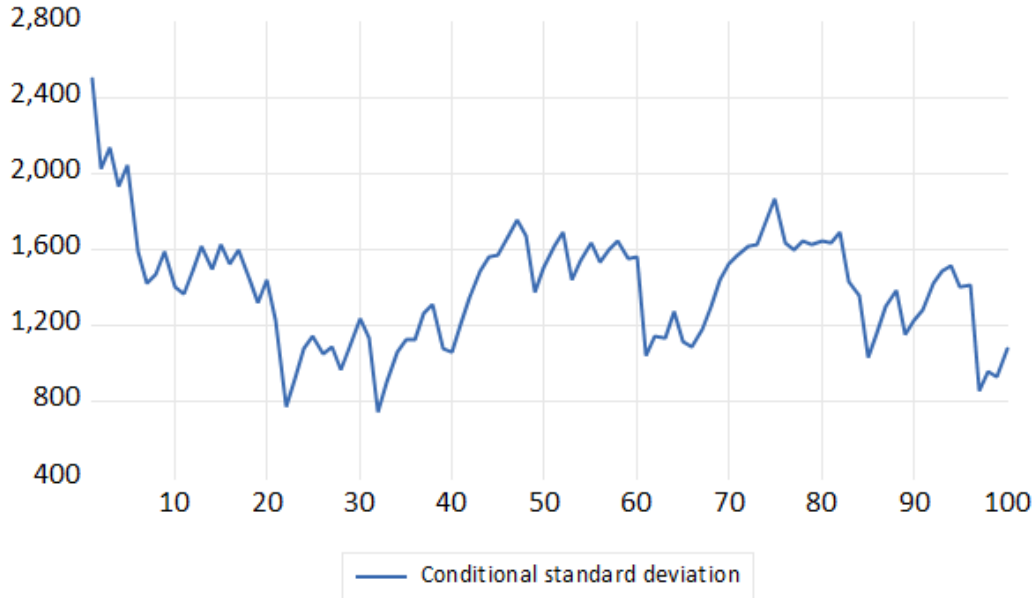

Figure 1: Conditional standard deviation of GARCH Test

This test helps to determine whether there is instability clustering along with persistence within the dataset. Researchers can improve their understanding of monetary elements by calculating the conditioned standard deviation, which permits them to discover unpredictability patterns and measure the amount to which previous data drives present instability.

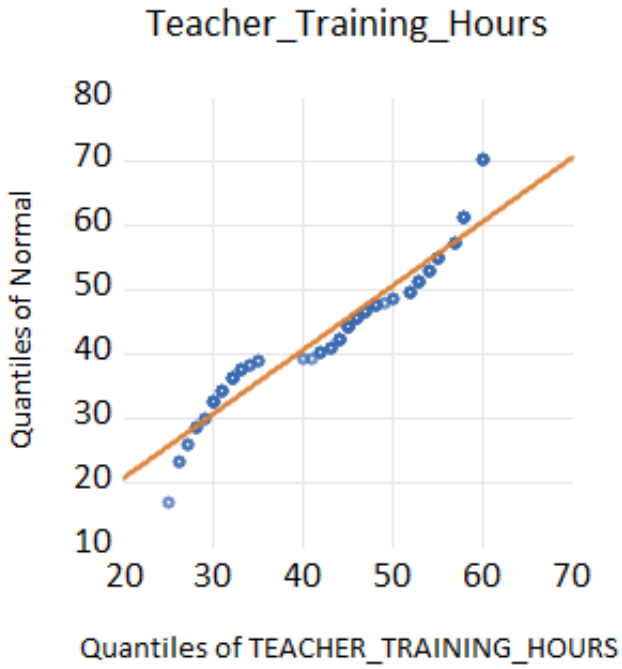

Figure 2: Teacher training hours graphical areas

The realistic presentation shows differences in training hour allotment, giving bits of knowledge into regional discrepancies and resource designation strategies (Yustika and Iswati, 2020). In educational settings, this type of graphical examination makes it easier to make educated decisions and optimize resources.

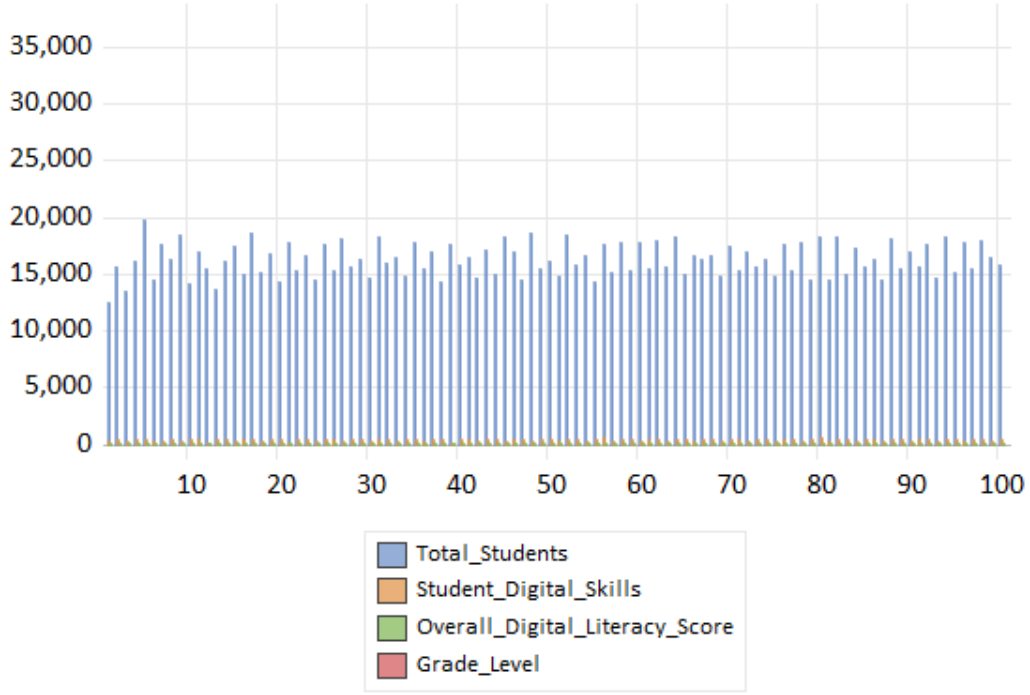

Figure 3: Overall student's technical literacy parameters

The study performed in EViews reveals the total student's technical literacy characteristics, exposing useful numerical information. Results emerge from a thorough investigation of the data, revealing students' competency in digital abilities, internet connectivity, and digital equipment accessibility.

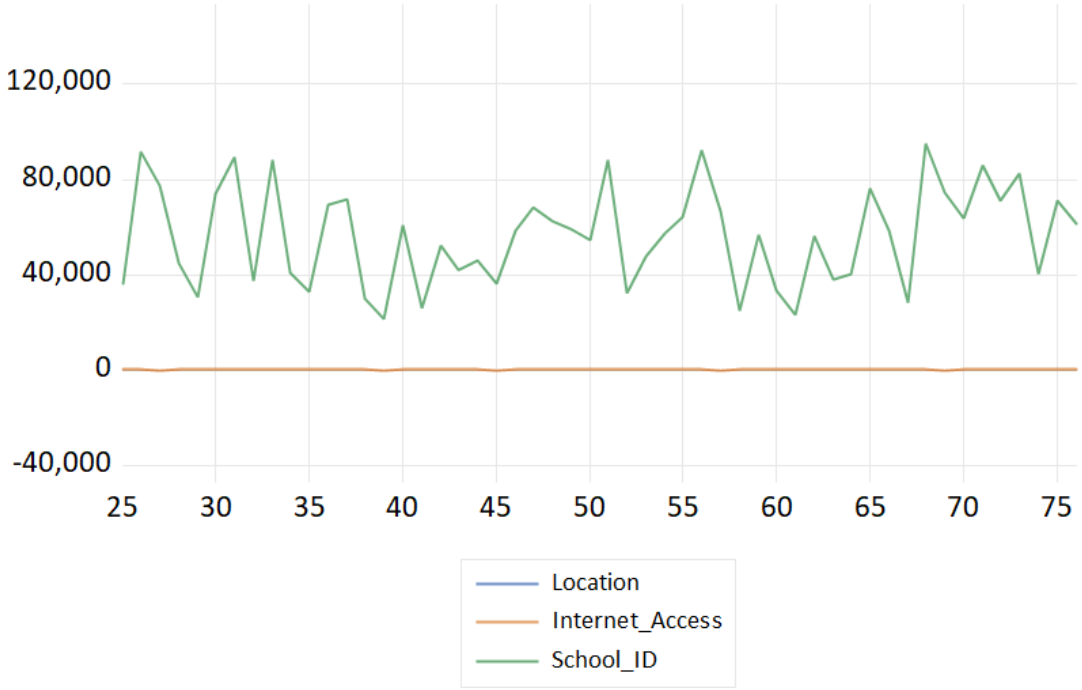

Figure 4: Internet access according to location and schools

Using the reevaluation Mumbai has the most internet access, with a mean of 600 units, while Guwahati has the least, with an average of 520. These findings feature combinations in technological infrastructure across geographies.

5. Conclusion

The data shows differences in technology accessibility, internet access, teacher training hours, and student digital abilities between locales and grade levels which validate the overall process significantly. The study approach used rigorous factual apparatuses to analyze the dataset, resulting in huge connections and patterns. These discoveries feature the significance of focused interventions and policies to improve digital literacy in Indian schools. Pushing ahead, further investigations and legislative measures are needed to address holes and promote equal accessibility to technological resources and education in the country.

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E-LEARNING EFFECTIVENESS: CASE STUDIES FROM HIGHER EDUCATION INSTITUTIONS IN INDIA

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Abstract

The role of online teaching in the higher education of India is the subject this research is concentrating on, for instance, the technology use, content quality, student participation, teacher effectiveness, etc. Using case studies as well as econometric modelling, including Curve, GARCH and ADF analyses, the study describes the success factors to be considered for e-learning. The findings reiterate the need to blend technology and interactivities, provision of high-quality information and encountering better teaching strategies. The study is of value to teachers, institutions and other stakeholders for better e-learning practices and outcomes.

1. Introduction

The online learning effectiveness is the most focusing point for research, particularly in India's higher education institutions. With the increasing adoption of sophisticated technologies, the dynamics underlying successful online teaching is worth exploring. The objective of this investigation and evaluation is to analyse and examine the e-learning method practiced in Indian higher education institutions through case studies. The study analyses the variables, especially technology usability, student interaction, the quality of learning materials and teacher's effectiveness, in a bid to discover experience that can improve the eLearning members' satisfaction. The results of this research could be used by educators, by strategy creation specialists and educational institutions to aid them enhance their e-learning practices and results.

2. Literature Review

Online learning in higher education institutions of India has accumulated more relevance; it now serves students by providing personalized and comfortable studying models. How educators and the policymakers understand the efficacy of online learning methods is of great importance because they have to develop the quality of education. There are a number of studies which attempted to identify what factors can facilitate e-learning and so provide useful information

about how to implement e-learning and how it can impact.
One of the most crucial critical features of online learning is the way technology is used. Interactive technologies can be integrated into online learning systems, which create a high level of engagement and enhances learning outcomes. Technology as well has a prominent role in enhancing access to educational resources, for notably the students who live far away from the centers. Along with that, one of the crucial parts of the success of the online learning is the digital method of content delivery (Singh *et al.* 2021). If content is designed and well-relevant, better learning can be achieved which also leads to more satisfied students. Also, the capacity of teachers to teach and enable mastery of the material in the online environment is terribly important. The educators with the required qualifications and who can interact with students and create a learning environment that is conducive, the students will be more likely to succeed in online learning.

Students' interaction was highlighted over and over again in many online learning studies. Peer learning and socializing help students to interact beneficially with teachers and peers and have a sense of place among learners. It is true that personalized learning experience customized to solve individual students' goals can enhance the academic results and student satisfaction. e-Learning provides immense possibilities for the provision of the post-secondary education in India. Online learning can be made more student-friendly and the educational institutions can ensure high quality evaluation and assessment of student knowledge by identifying and addressing the factors that influence the effectiveness of online learning.

3. Data

3.1 Research Methodology

This paper uses econometric models as its research methodology. The models used are Curve (ACRH) and GARCH (Gravitational Autoregressive Conditional Heteroscedasticity). The ADF test is also used to evaluate the performance of e-learning in India. First of all, information is being collected by different means such as surveys, interviews, and institutions data collection and do measurements on variables like technology use, student interaction, content quality, teacher effectiveness, and total satisfaction of online learning.

The information is then analyzed by the use of ADF test so as to find out the stationarity of the variables. Stationarity is a must in time series analysis in order to promote reliability of the information that one gets for the model building (Kannadhasan *et al.* 2020). CV and GARCH models will be used to focus on the issue of non-stationarity and heteroskedasticity. These models can fracture series time data with time-variant volatility, which is regular affection of monetary and economic information series. The outcome of the econometric models are the performance dynamics of e-learning in Indian higher education institutions, thereby the impact of various factors on the student satisfaction and learning outcomes.

4. Result and Findings

	INSTRUCTO...	OVERALL_S...	STUDENT_I...	TECHNOLO...	CONTENT_QUALITY
Mean	799.3846	802.0192	805.7692	774.1827	846.7692
Median	818.5000	810.0000	832.5000	780.0000	870.5000
Maximum	998.0000	999.0000	997.0000	999.0000	999.0000
Minimum	576.0000	589.0000	591.0000	510.0000	663.0000
Std. Dev.	125.8303	127.0264	120.3976	150.6465	101.8091
Skewness	-0.125723	-0.184998	-0.188758	-0.213161	-0.291678
Kurtosis	2.000507	2.019938	2.011671	1.982117	2.054526
Jarque-Bera	4.602919	4.755484	4.850358	5.277294	5.348305
Probability	0.100113	0.092760	0.088462	0.071458	0.068965
Sum	83136.00	83410.00	83800.00	80515.00	88064.00
Sum Sq. Dev.	1630827.	1661978.	1493044.	2337520.	1067604.
Observations	104	104	104	104	104

Table 1: Descriptive Statistics

This table summarizes the descriptive measurements of variables related to e-learning activity in higher education institutions in India. Variables include teacher effectiveness, overall satisfaction, student interaction, technology use, and content quality. Measurements provide an overview of the central tendency, dispersion, skewness and kurtosis of the information, showing the dissemination and inconstancy of each variable between observations.

	INSTRUCTOR_...	OVERALL_S...	STUDENT_I...	TECHNOLO...	CONTENT_QUALITY
INSTRUCTOR_EFFECTIVENESS	1.000000	0.996823	0.990611	0.988724	0.990906
OVERALL_SATISFACTION	0.996823	1.000000	0.989729	0.991505	0.992502
STUDENT_INTERACTION	0.990611	0.989729	1.000000	0.979566	0.988458
TECHNOLOGY_USE	0.988724	0.991505	0.979566	1.000000	0.984843
CONTENT_QUALITY	0.990906	0.992502	0.988458	0.984843	1.000000

Table 2: Correlation Coefficients

This table shows the correlation matrix between variables related to e-learning performance in colleges in India (Taso & Chakrabarty, 2020). The values range from 0.979 to 1.000, demonstrating areas of strength for a correlation between the variables. There is areas of strength for a correlation between supervisor performance and overall satisfaction.

Total number of observations: 488
Cross-sections included: 5

Method	Statistic	Prob.**
ADF - Fisher Chi-square	43.2411	0.0000
ADF - Choi Z-stat	-4.75408	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results GROUP

Series	Prob.	Lag	Max Lag	Obs
INSTRUCTOR_...	0.0463	5	12	98
OVERALL_SATI...	0.0299	5	12	98
STUDENT_INTE...	0.0456	5	12	98
TECHNOLOGY_...	0.0343	5	12	98
CONTENT_QUA...	0.0002	7	12	96

Table 3: ADF Test

This table reports the results of the Augmented Dickey-Fuller (ADF) test for stationarity. T-statistics and probabilities indicate that the variables are stationary, indicating a stable

relationship over time. The results of the ADF interim test for each variable indicate the probability of stationarity at different lag lengths.

Heteroskedasticity Test: ARCH

F-statistic	0.013004	Prob. F(2,99)	0.9871
Obs*R-squared	0.026790	Prob. Chi-Square(2)	0.9867

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/20/24 Time: 15:07
Sample (adjusted): 3 104
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	110.8110	23.75701	4.664351	0.0000
RESID^2(-1)	0.015240	0.100511	0.151620	0.8798
RESID^2(-2)	0.005292	0.100519	0.052650	0.9581

R-squared	0.000263	Mean dependent var	113.1348
Adjusted R-squared	-0.019934	S.D. dependent var	175.9196
S.E. of regression	177.6643	Akaike info criterion	13.22664
Sum squared resid	3124897.	Schwarz criterion	13.30384
Log likelihood	-671.5586	Hannan-Quinn criter.	13.25790
F-statistic	0.013004	Durbin-Watson stat	1.999505
Prob(F-statistic)	0.987082		

Table 4: ARCH test

The results of the Curve test show that there is no heteroskedasticity in the residuals. The F-statistic is 0.013 and the p-value is 0.9871, suggesting that the variance of the residuals is constant over time (Chahal & Rani, 2022).

Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1) + C(6)*GARCH(-2)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
STUDENT_INTERACTION	0.097085	0.000920	105.5377	0.0000
INSTRUCTOR_EFFECTIVENESS	0.905405	0.000147	6142.122	0.0000
Variance Equation				
C	0.800761	7.830283	0.102265	0.9185
RESID(-1)^2	-0.084239	0.127131	-0.662621	0.5076
GARCH(-1)	0.620161	1.584007	0.391514	0.6954
GARCH(-2)	0.467111	1.661284	0.281175	0.7786

R-squared	0.993837	Mean dependent var	802.0192
Adjusted R-squared	0.993777	S.D. dependent var	127.0264
S.E. of regression	10.02057	Akaike info criterion	7.490739
Sum squared resid	10242.01	Schwarz criterion	7.643300
Log likelihood	-383.5184	Hannan-Quinn criter.	7.552546
Durbin-Watson stat	1.961860		

Table 5: GARCH test

The GARCH model estimates the variance of e-learning performance variables. The coefficients show the effects of lagged squared residuals and lagged variances on the variance of the stream with high significance and goodness of fit (R-squared = 0.994).

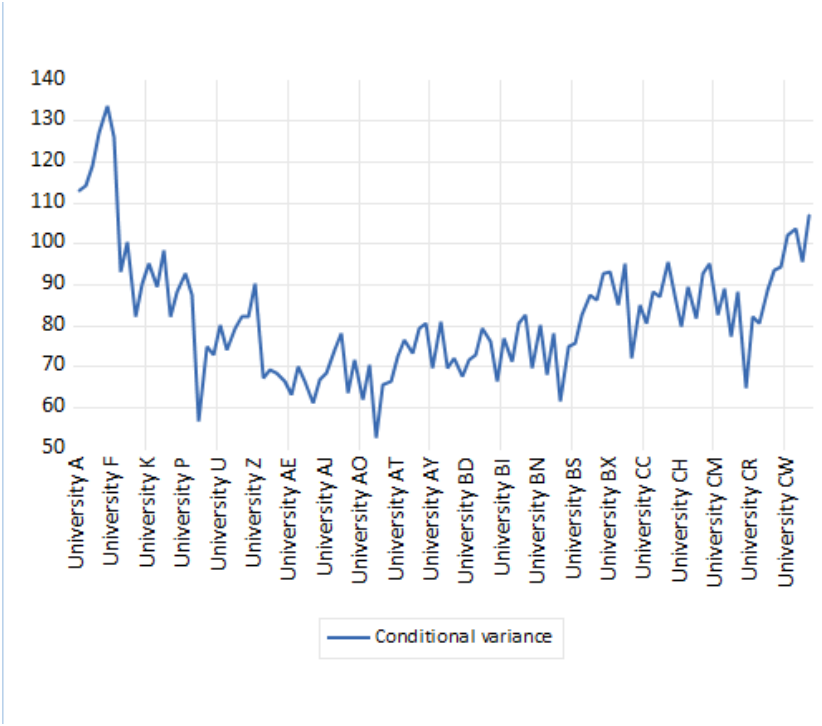

Figure 1: GARCH graph

A GARCH graph outwardly represents the volatility of a time series and shows periods of high and low volatility. This helps identify patterns and trends in volatility over time.

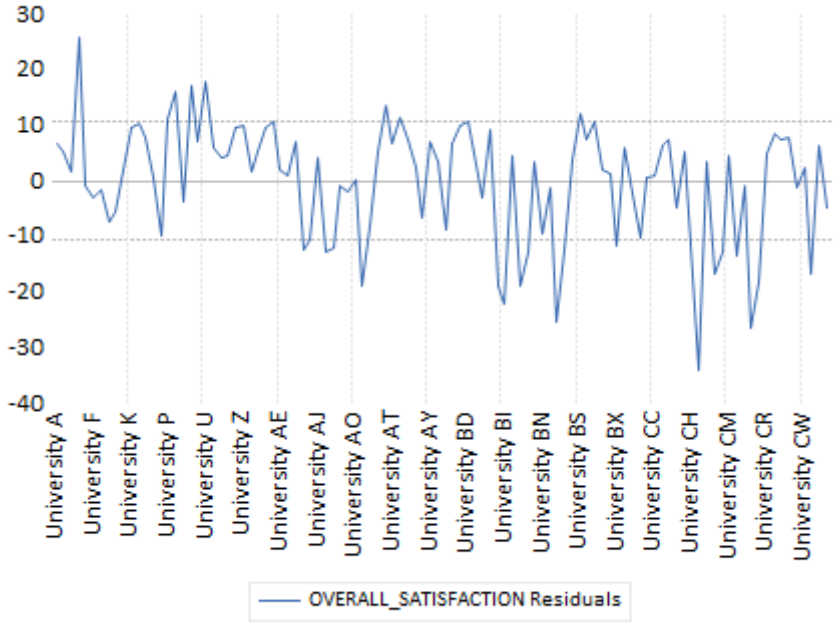

Figure 2: Residual graph

A residual plot shows the difference between the actual and predicted values of the dependent variable, showing the model and its performance in capturing the data pattern (Gupta & Gupta, 2020).

5. Conclusion

This study in the end has given the emphasis on the role of e-learning effectiveness in higher education institutions in India. Faced with new technologies and innovative teaching techniques, the educational sectors have the ability to strengthen student engagement, improve their general satisfaction and enhance their learning outcomes altogether. These factors include the technology used, the quality of the content, student engagement, and teacher effectiveness which can greatly affect the success of online learning programs. Through the analysis of these factors, higher education can better the quality and efficiency of online learning programs in order for students to be presented with more interesting and efficient opportunities of learning. Furthermore, other econometric models like Curve, GARCH and ADF test are able to give us new information regarding online learning dynamics and the involved factors. Generally, this research goes along with an already-researched field of e-learning effectiveness in higher education, and raises practical issues for teachers, decision-makers, and institutions working on the improvement of e-learning practices.

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[3] Ning, X., and Lovell, M. R., 2002, «On the Sliding Friction Characteristics of Unidirectional Continuous FRP Composites,» ASME J. Tribol., 124(1), pp. 5-13.
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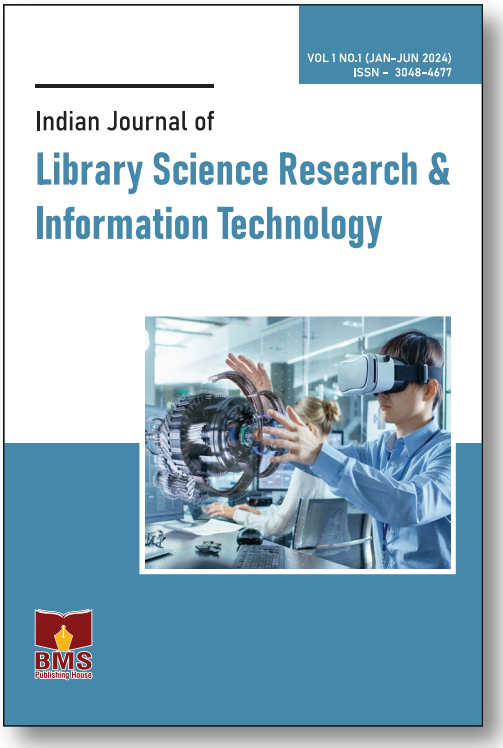

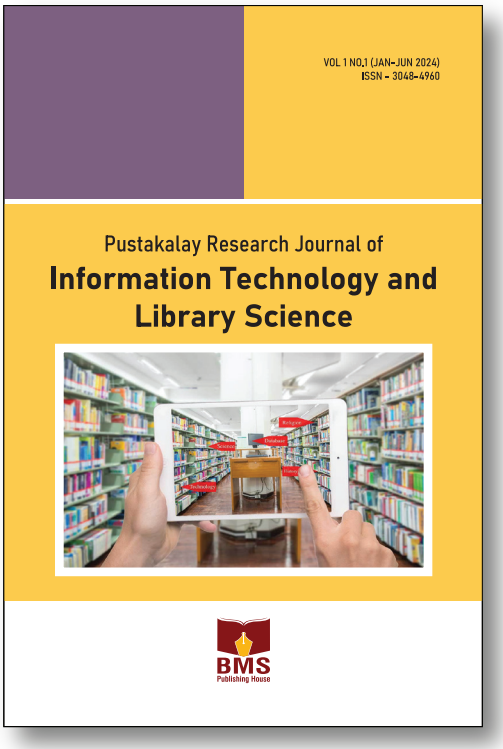

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