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ANALYZING USAGE AND EFFECTIVENESS OF E-LEARNING APPLICATIONS AMONG RURAL AND URBAN STUDENTS: AN EMPIRICAL STUDY

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Abstract

Although Information communication technology was bound to transform teaching learning pedagogy in developing nations, advent of Covid-19 and subsequent nation-wide lock down has acted as a catalyst for the process. Experience from developed world has shown that Information Communication Technology enhances learning process. In India there has always been a prevalence of dichotomy of resources between rural and urban regions. Government of India has taken initiatives like Provision of Urban Amenities to Rural Areas, Pradhan Mantri Jan Dhan Yojana, Deendayal Upadhyaya Gram Jyoti Yojana, Pradhan Mantri Sahaj Bijli Har Gar Yojana to strengthen socio economic infrastructure in rural area. Along with this some of the State Governments like that of Karnataka and Uttar Pradesh have initiatives to promote digital learning among students in both urban and rural areas. In this context it becomes pertinent to analyze whether students in rural area are on par with the students in urban area to access digital learning. This is even more relevant as nearly 65% of Indian population resides in rural areas. Our research paper aims to suggest appropriate policy suggestions to bridge this gap, if any.

Keywords: Digital devices, E-Applications, Rural and urban students, Information Communication Technology, Learning Outcomes

INTRODUCTION

A wise man once remarked, nothing but change is permanent in this everchanging world. Traditional mode of learning has undergone a radical change through the advent of internet revolution. The impact of it this was profoundly felt in developed world. Educational institutions of the developed world have resourcefully amalgamated information communication technology with educational domain and have grown geometrically in the field of research and development (Buchanan, 1999, Peters, O., 2000, Selwyn 2016, Milligan, 2010). Dawn of 21st century has witnessed developing countries realize the importance and effectiveness of Information Communication Technology (Internet Society, 2016, Kumar, B. A et al., 2020, Malik, Manju., 2001, Singh, H.,2003, Haryani, H et al., 2012), Digital devices and learning applications in enhancing learning experience and outcome of students (Stosic, Lazar.,2015, Sutapa Bose, 2008, Ravi Mahajan, 2011). Few of Indian states have also been striving to encourage their students to productively utilize digital learning technology by providing them digital devices free of cost (Nadaf, Dr-Zaffar, 2017). Advent of Covid-19 followed by subsequent nationwide lockdown, has hastened the

process of needing to integrate technology in learning worldwide, more so in developing countries. Whether one likes it or not, Information communication technology is here not only to stay, but also to radically change the pedagogy of teaching and learning. However, just having physical access to digital devices might not be enough to effectively utilize them. It must be complemented with necessary socio-economic infrastructure, failing which the digital devices in themselves, are of little use. Rural Urban dichotomy always has been a feature of Indian socio-economical structure. To bridge the socio-economic dichotomy which is prevalent between urban and rural India, Indian Government has undertaken several initiatives like Provision of Urban Amenities to Rural Areas, Pradhan Mantri Jan Dhan Yojana, Deendayal Upadhyaya Gram Jyoti Yojana, Pradhan Mantri Sahaj Bijli Har Gar Yojana to strengthen socio economic infrastructure in rural area. Along with this some of the State Governments like that of Karnataka and Uttar Pradesh have initiatives to promote digital learning among students in both urban and rural areas. In this context it becomes pertinent to analyze whether students in rural area are on par with the students in urban area to access digital learning.

In this backdrop, our study tries to analyze as to whether rural students have adequate and reliable socio-economic infrastructure at their disposal for accessing e-learning on par with students belonging to urban areas.

LITERATURE REVIEW

Later half of 20th century witnessed an increasing amalgamation of technology in the field of teaching learning pedagogy, particularly in the developed world. By the end of 20th century, the integration of Information Communication Technology in the educational domain had not only become new normal but also had become more effective and had made the learning process more wholistic and fulfilling (Anu Sharma et al., 2011, Kearney et al., 2012). There are many studies which have been undertaken in the developed world which clearly show, learning outcome is enhanced by information communication technology. However, the same cannot be said in context of resource scare developing world.

Although Information Communication Technology definitely has the potential to enhance the effectiveness and efficacy of learning outcomes, the teachers are hesitant to imbibe the same because of lack of understanding and experience. With the advent of internet revolution in the 21st century which resulted in drastic reduction in cost of internet and digital devices, internet penetration in India has seen a consistent rise in last two decades. However, in the academia, particularly in the context of developing world in general and India in particular, traditional mode of education was more popular. This was primarily on account of two reasons which were, on one hand, teachers were reluctant to inculcate information communication technology in teaching learning pedagogy due to scarcity of institutional resources and on the other hand there was no necessity for them to make the effort. If at all Information communication technology was in use, it was limited to high end educational institutions located in major metropolitan cities. Although some of visionary state governments like that of Uttar Pradesh and Karnataka were distributing digital devices for students pursuing higher education at free of cost, more often than not, it was not utilized for the said matter. However, oncoming of Covid-19 and subsequent nation-wide lockdown for nearly 8 months in two years necessitated (Merinoni, Land & Jensen,2020) both teachers and students to adopt information communication technology in teaching learning pedagogy ((UNESCO 2020., UGC,2020). This time, the adoption was not only confined to infrastructurally better of urban areas, but it was also thrust upon rural areas. Fortunately, it has had two positive implications. On the one hand, both Central and state Governments have realized that the online learning is here to stay.

This is reflected by many state and central universities providing online education on one hand and on the other, UGC setting up the mandate of offering 83 Undergraduate and 43 Postgraduate Massive Open Online Courses in its SWAYAM platform for the session of July 2021. Information Communication Technology is bringing about noticeable shift in teaching learning pedagogy. The teaching learning pedagogy is shifting from teacher centric mode to student centric mode with the advent of ICT which has created a conducive environment for self-learning, also known as web 2.0. Although the stage is set for tectonic shift in teaching learning pedagogy due to advent of ICT, is entire India ready to adopt the same is the question which needs to be answered. Given, that the powers to be have realized the importance and necessity of ICT in educational domain, it becomes relevant for us to understand the factors affecting use of technology in enhancing learning outcomes between rural and urban students. In India since past decade, digitalization through programs like Jan Dhan Yojana, Digital India coupled with cheaper internet with advent of 4G, internet penetration has been on the rise. This study tries to understand as to whether students belonging to rural villages have adequate socio-economic infrastructure in place to cope up with the new normal as the students in urban cities, particularly when Tier 1 metropolitan cities of India have infrastructure that can rival that of the developed world.

RESEARCH GAP

Based on the premise that Information communication technology is here to stay and radicalize teaching learning pedagogy from teacher centric approach to student centric approach, the pertinent question which needs to be answered is whether students in rural area are well equipped to cope up with new norm as the students in urban area. The following research paper tries to bridge the research gap in the above area.

OBJECTIVES

- To compare the usage and usefulness of learning applications among urban and rural students.
- To compare the perceptions about learning and its outcomes between rural and urban students

HYPOTHESES

- There is no significant difference between rural and urban students concerning usage and effectiveness of learning applications.
- There is no significant difference between rural and urban students regarding learning perceptions & outcomes through digital devices.

METHODOLOGY

Hypotheses set for the study have been empirically verified by utilizing the primary data collected from 740 respondents. Sample respondents have been selected by using multistage random sampling method. In the first stage 3 conventional universities have been randomly selected and in the second stage 2 colleges offering graduate and post graduate courses were randomly selected by using lottery method. From each college 10 percent of the students were randomly selected by using lottery method. Post enumerative classification of the respondents into rural and urban residents were made for comparative analysis. Primary data has been collected by using well structured pre-tested schedule. The schedule was designed to illicit information concerning economic status, usage pattern of digital devices and perceptions

regarding e-learning outcomes.

Questionnaire's reliability was verified by using Cronbach's Alfa, the value of which was found to be 0.60 for 26 items which is of acceptable standards (>=0.60). For analyzing the significance of association between relevant variables pre-dominantly chi-square test has been used. To understand the factors affecting e-learning outcomes binomial logistic regression model has been used.

Binomial Logistic Regression Model:

Binary Logistic Regression Model is helpful in predicting the probability of one of the two categorical outcomes which is usually designated as a "success". The other categorical outcome is considered as reference category.

The framework of Logistic Regression Model for a dichotomous categorical variable 'Y' with multiple explanatory variables (x_1, x_2, x_3 …. x_k) can be represented with the help of the following equation (Ari, Erkan.,2016),

$$\text{Logit } [P(Y=1)] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \ldots + \beta_k x_k$$

Which can be represented by directly specifying π(x) as:

$$\pi(x) = \frac{n\exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{1 + \exp(\alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}$$

In the above equation β_i refers to the effect of x_i on the log odds that Y=1, controlling other x_j (Ari, Erkan.,2016)..

Identification of Variables:

Dependent Variable: The entire premise of the research is based on trying to understand whether students belonging to rural area are sufficiently equipped to cope up with the radical shift which is happening in teaching learning pedagogy. Hence based on this context, the dependent variable was chosen as perceived satisfaction from e-learning through digital devices among students. The frequencies of dependent variable across tested categories is summarized in Table 1:

Table 1: Frequencies across tested categories of Dependent Variable

Level of Satisfaction from e-Learning	Frequency	Percentage
Satisfied	444	0.60
Unsatisfied	296	0.40

Independent Variables: Based on our experience and review of literature, the following independent variables were chosen to analyze the various factors effect of various independent variables on the nature of residence and subsequent e-learning outcomes. The explanatory variables are as under:

X_1 = Dummy for using mobile Mobile; if not using, 0; if using, 1.

X_2 = Dummy for using Tablet; if not using, 0; if using, 1.

X_3 = Dummy for using PC; if not using, 0; if using, 1.

X_4 = Dummy for using Laptop; if not using, 0; if using, 1.

X_5 = Dummy for Device Ownership ; if Internet Cafe, 1; if ownership is of neighbors, 2; if ownership is of family, 3; if device is self owned, 4.
X_6 = Dummy for Network Coverage; if not satisfactory, 1; if good, 2; if better,3.
X_7 = Dummy for Availability of Electricity; if not satisfactory, 1; if good, 2; if better,3.
X_8 = Dummy for time spent on internet for studies; 1 for 0-3 hours; 2 for 3 to 6 hours; and 3 for more than 6 hours.
X_9 = Dummy for usage of YouTube for academics; 1 for rarely ; 2 for sometimes; 3 for most of the times; and 4 for regularly.
X_{10} = Dummy for usage of Educational websites for academics; 1 for rarely ; 2 for sometimes; 3 for most of the times; and 4 for regularly.
X_{11} = Dummy for usage of Educational apps for academics; 1 for rarely ; 2 for sometimes; 3 for most of the times; and 4 for regularly.
X_{12} = Dummy for usage of Video Conferencing Apps for academics; 1 for rarely ; 2 for sometimes; 3 for most of the times; and 4 for regularly.
X_{13} = Dummy for usefulness of Youtube in e-learning: 1 useful; 0 not useful;
X_{14} = Dummy for usefulness of Educational Websites in e-learning: 1 useful; 0 not useful
X_{15} = Dummy for usefulness of Educational Applications in e-learning: 1 useful; 0 not useful
X_{16} = Dummy for usefulness of Video Conferencing Applications in e-learning: 1 useful; 0 not useful;

X_{17} = Dummy for Medium of reading; if reading directly, 1; if taking print out, 2.
X_{18} = Dummy for Remembering things which have been read from digital devices; if bad, 1; if satisfactory, 2; if good,3.
X_{20} = Dummy for concentration during online classes; if not satisfactory, 1; if manageable, 2; if good,3.
X_{21} = Dummy for Technical Problems during online classes; if not satisfactory, 1; if manageable, 2; if good ,3.
X_{22} = Dummy for Per Capita Income; if belonging to lower level,0 ; if belonging to higher level, 1;
X_{23} = Dummy for Place of Residence; if belonging to rural region,0 ; if belonging to urban region, 1;

Reliability of the model:

Reliability of binomial logistic regression model is validated through Hosmer-Lemeshow Goodness of fit test, proportion by chance accuracy criterion and McFadden's Pseudo r square

Hosmer-Lemeshow Goodness of fit test for Binomial Logistic Regression Model: Hosmer-Lemeshow test mostly used to evaluate the reliability of risk prediction models. The test is used to assess as to whether observed event rates match up with the expected event rates. Subgroups are identified as deciles in Hosmer-Lemeshow test. If observed event rates are similar to expected event rates, such models are considered as being well calibrated.

$$H = \sum_{g=1}^{G} \frac{(O_{1g} - E_{1g})^2}{N_g \pi_g (1 - \pi_g)}$$

In the above equation H represents Hosmer-Lemeshow Test statistic; O_{1g} observed Y=1 events, ; E_{1g} represents expected y=1 events; N_g represents total observations, π_g represents predicted risk for the g^{th} risk decile group and G represents the number of groups.

The results for Hosmer-Lemeshow test for our model is summarized in the table below:

Table 2: Hosmer Lemeshow Goodness of fit test

Observations	No. Outcome Values	Base outcome value	Number of groups	χ^2 Statistic	Prob > χ^2
740	02	00	10	11.84	0.158

From Table 2, we can conclude that, Hosmer-Lemeshow Test statistic is not significant, which implies that we do not have enough evidence to reject our null hypothesis. Hence, we can reliably conclude that our observed and expected proportions are the same across all groups.

McFadden's Pseudo R Square:

McFadden's Pseudo R Square is one of the prominent statistical tools to validate the goodness of fit for a binomial logistic regression model. McFadden's Pseudo R Square for our model was estimated by STATA to be 0.4, which according to McFadden (1977, p.35) is a reliably (0.2 to 0.4) good fit.

Proportion by Chance Accuracy Criterion: Reliability of the accuracy of the model can be computed through Proportion by Chance accuracy criterion. Calculation of Proportion for each group is done on the basis of the number of cases found in each group of the dependent variable. Then, proportion of cases in each group is squared and totaled ($0.60^2 + 0.40^2$) = 0.52. To improve the accuracy of Binomial Logistic Regression Model over the accuracy achievable by chance alone, we set the benchmark by 25%. Thus, our final benchmark set up by proportion by chance accuracy criterion is: 1.25 * 0.52 = 0.65, which is 65 percent.

Table 3: Classification of the Selected Model

Categorical Outcomes	Predicted		
	Dissatisfied	Satisfied	Percent correct

Students dissatisfied from e-learning	234	57	80.4
Students satisfied from e-learning	62	387	86.2
Overall Percentage			83.9

From table 3, we can observe that the overall accuracy of our model is 87.3 percentage which is higher than the benchmark set by Proportion by chance accuracy Criterion (65%). Hence, we can conclude that the predictions made by our model is reliable.

Results and Discussion:

E -Learning is a capital-intensive process. In this context it becomes pertinent for us to evaluate the economic status of the student's families who are residing in urban and rural areas.

Table 4: Significance of Association between Per Capita Income and Place of Residence

Economic Status	**Level of PCI**	**Place of Residence**			**Fishers Exact Value (Probability) / Chi Square**
		Rural	**Urban**	**Total**	
Per Capita Income	Relatively Poor	284 (61.08)	35 (12.73)	319 (43.11)	Chi- Square 164.70 (Pr = 0.000)
	Relatively Rich	181 (38.92)	240 (87.27)	421 (56.89)	
	Total	465 (100.00)	275 (100.00)	740 (100.00)	

From the above table , we can see thathjijijrrr From the

Based on Market value of household assets and occupation of working professionals, per capita income was derived which was later bifurcated as relatively rich and relatively poor. When we observe residence of students based on the per capita income of their family as summarized in Table 4, we observe that, majority (61.08%) of the students who belong to family having low per capita income reside in rural areas. On the other hand, majority (87.27%) of students belonging to families having high per capita income reside in urban areas.

Table 5 throws light on the significance of association between usage of devices and residential place of the students. Through our survey we have found out that, socio economic status played a vital role in dictating the choice of devices used by the students for the purpose of learning.

Table 5: Significance of Association between Usage of Devices and Place of Residence

From the above table we can clearly see that, majority of rural students have accessed mobile for the purpose of learning whereas when it comes to expensive digital gadgets like Tablet, Personal Computer or Laptop, the majority of the students who have access to the same are urban students. The said inference has been validated through relevant statistical tests.

Only usage of devices by the students does not reflect the effectiveness of the devices in enhancing the learning experiences among students. So, with the help of Likert Scale and suitable statistical tests an attempt was made to understand the significance of association between usage of digital devices and effectiveness of the same in context of place of residence among students. The results have been

Utilization of Technology	Factors	Place of Residence			ishers Exact Value (Probability) / Chi Square
		Rural	Urban	Total	
Access to Mobile	No	10(02.15)	14 (5.09)	24 (3.24)	Chi-Square 4.76 (Pr=0.029)
	Yes	455 (97.85)	261 (94.91)	716 (96.76)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Access to Tablet	No	462 (99.35)	267 (97.09)	729 (98.51)	Fisher's exact 0.037
	Yes	03 (00.65)	08 (2.91)	11 (01.49)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Access to PC	No	458 (98.49)	258 (93.82)	716 (96.76)	Chi-Square 12.04 (Pr = 0.001)
	Yes	07 (1.51)	17 (06.18)	24 (3.24)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Access to Laptop	No	414 (89.03)	202 (73.45)	616 (83.24)	Chi-Square 30.06 (Pr = 0.000)
	Yes	51 (10.97)	73 (26.55)	124 (16.76)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	

summarized in table 6. From the table, we can observe that, usage and utility of YouTube is more nuanced among urban students as compared to rural students. The above inferences have been validated through chi-square tests which were found to be significant at 1 percent probability.

In case of Educational Websites, meaningful inference could not be made as to which group was using educational websites for longer duration, when it came to utility, we observe that, rural students found the educational websites to be more useful. This has been validated through relevant statistical test which was found to be significant at 1 percent probability level. Even more interesting observation has emerged from the study, which concerns with usage and utility of Educational Applications. From our study, we found out that, students belonging to rural region found Educational applications more useful and engaging than students belonging to urban areas. From personal experience of teaching graduate and post graduate students in rural areas, it doesn't seem entirely farfetched as our students belonging to rural regions

prominently use applications for translating English text to regional language for the purpose of learning and understanding digital content.

Finally, when we saw the trend of usage and utility of Video Conferencing applications, we found out that students belonging to urban regions were not only more inclined towards using video conferencing apps but also found usage of video conferencing applications more useful. This does seem to make logical sense on two accounts. On one hand attending Video Conferences requires better network connectivity which is more likely to be found in urban areas as compared to rural areas. On the other hand, most of the webinars are more likely to be conducted in English rather than regional language, hence students from urban background are likely to get more utility from the same.

Table 6: Significance of Association between Usage and Effectiveness of TechnologicalApplications and Place of Residence

Utilization of Technology	Factors	Place of Residence			Fishers Exact Value (Probability) / Chi Square
		Rural	Urban	Total	
Usage	Not Using	68 (14.62)	20 (07.27)	84 (11.89)	Chi-Square 08.91 (Pr=0.003)
	Using	397 (85.38)	255 (92.37)	652 (88.11)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Usefulness of	Not at all	62 (13.33)	19 (06.91)	81 (10.95)	Chi-Square 39.22 (Pr=0.0000)
	Rarely	95 (20.43)	23 (08.36)	118 (15.95)	
	Sometimes	159 (34.19)	91 (33.09)	250 (33.78)	
	Mostly	149 (32.04)	142 (51.64)	291 (39.32)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Usage	Not Using	62 (13.33)	28 (10.18)	90 (12.16)	Chi-Square 01.60 (Pr=0.205)
	Using	403 (86.67)	247 (89.82)	650 (87.84)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Usefulness of Educational	Not at all	60 (12.90)	25 (09.09)	85 (11.49)	Chi-Square 13.34 (Pr = 0.004)
	Rarely	73 (15.70)	62 (22.55)	135 (18.24)	
	Sometimes	159 (34.19)	112 (39.88)	271 (36.62)	
	Mostly	173 (37.20)	76 (37.64)	249 (33.65)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Usage of	Not Using	147 (31.61)	139 (50.55)	286 (38.65)	Chi- Square 26.12 (Pr = 0.000)
	Using	318 (68.39)	136 (49.45)	454 (61.35)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Usefulness of	Not at all	148 (31.83)	140 (50.91)	288 (38.92)	Chi-Square 43.38 (Pr = 0.000)
	Rarely	108 (23.23)	74 (26.91)	182 (24.59)	
	Sometimes	136 (29.25)	46 (16.73)	182 (24.59)	
	Mostly	73 (15.70)	15 (05.45)	88 (11.89)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
U	Not Using	92 (19.78)	27 (09.82)	119 (16.08)	Chi- Square

	Using	373 (80.22)	248 (90.18)	621 (83.92)	12.72
	Total	465 (100.00)	275 (100.00)	740(100.00)	(Pr = 0.000)
Usefulness of Conferencing	Not at all	86 (18.49)	26 (09.45)	112 (15.14)	Chi-Square 14.00 (Pr = 0.003)
	Rarely	115 (24.73)	60 (21.82)	175 (23.65)	
	Sometimes	161 (34.62)	114 (41.45)	275 (37.16)	
	Mostly	103 (22.15)	75 (27.27)	178 (24.05)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	

Effectiveness of learning experience can be inferred in more wholistic manner when we also analyze learning perceptions of the users. In Table 7, we have summarized the significance of association between learning perception and nature of residence among students. When we observed the amount of time which was spent on learning, our study found out that, students belonging to urban area spent more time on using digital devices for the purpose of learning as compared to students belonging to rural areas. This is also supported by subsequent result, which shows that, the urban students were least affected by technical problems as compared to the rural students. Both of the above inferences have been validated through Chi Square test statistic which were found to be statistically significant at 1 percent probability level. When it comes to maintenance of concentration among students, our study found out that rural students were able to maintain greater degree of concentration as opposed to students belonging to urban centers. This does make rational sense as prolonged exposure to digital gadgets tend to reduce the concentration level among students (The Economic Times,2018).

Table 7: Significance of Association between Learning Perceptions andPlace of Residence

Learning Perceptions	**Factors**	**Place of Residence**			**ishers Exact Value (Probability) / Chi Square**
		Rural	**Urban**	**Total**	
Time Spent on Learning	0-3 hours	319 (68.60)	139 (50.55)	458 (61.89)	Chi-Square 27.06 (Pr=0.000)
	3-6 hours	128 (27.53)	109 (39.64)	237 (32.03)	
	6 Hours and above	18 (03.87)	27 (09.82)	45 (06.08)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Concentration Level	Hardly Remember	103 (22.15)	97 (35.27)	200 (27.03)	Chi-Square 32.52 (Pr=0.000)
	Can Manage	172 (36.99)	117 (42.55)	289 (39.05)	
	Good	153 (32.90)	55 (20.00)	208 (28.11)	
	Excellent	37 (7.96)	06 (2.18)	43 (05.81)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
Technical Problems	Mostly	136 (29.25)	171 (62.18)	307 (41.49)	Chi-Square 77.29 (Pr=0.000)
	Sometimes	307 (66.02)	98 (35.64)	405 (54.73)	
	Not at all	22 (04.73)	06 (02.18)	28 (03.78)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	
De	Hardly	96 (20.65)	34 (12.36)	130 (17.57)	

	Sometimes	334 (71.83)	167 (60.73)	501 (67.70)	Chi-Square 53.96 (Pr=0.000)
	Mostly	35 (07.53)	74 (26.91)	109 (14.73)	
	Total	465 (100.00)	275 (100.00)	740(100.00)	

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However, Students from urban areas feel that the learning device has been useful in promoting overall learning experience. This can be justified with previous results which have shown that, students belonged to urban region had access to better infrastructure, better devices, used devices for a prolonged period of time and had least technical problems in doing so.

The results of binomial logistic regression model taking log odd ratios into consideration have been estimated through STATA statistical package which has been summarized in Table 8. When we analyzed the various factors, which are affecting the level of satisfaction among students in e-learning we found the following observations. In context of place of residence, we find that the estimated, log odd ratio is more than 1. This implies that, for each one unit increase of the value of the given variable, there is a greater odd of the case falling to base comparison category, which is predicted to change by a factor of 10.183. This inference was found to be statistically significant at 1 percent. In simpler terms it means that, effectiveness of

Table 8: Coefficient, Standard Error and Reverse Risk Ratio Estimates and $\boldsymbol{p}$ Values of the Multinomial Logistic Regression Model

Place of Residence	Effectiveness of Parameters	Estimates			
		Odds Ratio	Std. Err.	z	Probability>z
Comparison of satisfaction level from e-learning among students (Base Reference Category:	Place of Residence	10.183	3.695	6.39	0.000
	Using Mobile	00.571	0.392	0.41 6	0148
	Using Tablet	02.528	3.860	0.61	0.543
	Using PC	00.636	0.436	-0.66	0.510
	Using Laptop	00.849	0.273	-0.51	0.612
	Device Owner	1.160	0.220	0.79	0.432
	Network Coverage	1.217	0.201	1.19	0.234
	Availability of Electricity	0.842	0.172	-0.84	0.402
	Time Spent on Internet for Studies	0.692	0.124	-2.04	0.041
	Usage of YouTube	0.828	0.356	-0.44	0.662
	Usage of Educational Websites	0.973	0.437	-0.06	0.953
	Usage of Educational Applications	0.990	0.355	-0.03	0.979

	Usage of Video Conferencing Apps	1.474	0.601	0.95	0.341
	Usefulness of YouTube	1.073	0.155	0.49	0.626
	Usefulness of Educational Websites	1.271	0.195	1.56	0.119
	Usefulness of Educational Apps	1.016	0.166	0.10	0.921
	Usefulness of Video Conferencing Apps	0.718	0.108	-2.18	0.029
	Medium of reading	0.603	0.133	-2.28	0.023
	Remembering Things	3.573	1.075	4.23	0.000
	Concentration During Online Classes	1.520	0.218	2.92	0.004
	Technical Problems in online Classes	0.684	0.143	-1.81	0.071
	Usefulness of Tech in previous exam	1.824	0.328	3.34	0.001
	Per Capita Income	14.995	3.592	11.30	0.000
	Constant	0.0137	0.176	-3.35	0.001

e-learning is more prominent in urban region as opposed to rural region. This inference was on expected lines as socio economic gap between urban rural region is yet to be bridged in adequate manner. When we observed the time spent on internet for studies, the estimated log odd ratio was less than 1. This implies that, for each one unit increase of the given variable, there is a greater odd of the case falling to base reference category, which is predicted to change by a factor of 0.124. This inference was found to be statistically significant at 1 percent. In simpler terms it means the more the students use internet for the purpose of 'study', the less likely they are to be benefited from the same. This seems to be logical as although student's initial intention might have been to access internet for gaining academic knowledge, there is a tendency of them of getting distracted with social media and other things in internet. Video Conferencing has become a new platform for engaging in teaching and learning process. This is mostly because of nationwide lockdown imposed due to COVID-19. From our study we observe that Usefulness of Video Conferencing apps has an estimated odds ratio of less than one, which is statistically significant at 5 percent confidence interval. This means that, for every one unit increase in the given variable, the likelihood of the case falling into base reference category increases by a factor of 0.718. This implies that student's satisfaction level from e-learning is inversely related to use of video conferencing applications. This is in harmony with nationwide sentiment of student community who were largely dissatisfied with online classes which were conducted on video conferencing applications like Zoom, Google Meet and the like. When it comes to taking print out and reading therein, the estimated odds ratio is found to be less than one which was statistically significant at 5 percent confidence interval. In other words, it means that, for every one unit increase in the given variable, there is a greater likelihood of the case falling in base reference category. This seems to adversely affect the scope of e-learning. The above inference seems to be logical, as when a student takes print out and comes home for the purpose of studying and if he has

any supplementary doubts regarding the topic, he cannot easily get clarification for the same.

When we observe parameters pertaining to concentration level, remembering things and usefulness of technology in previous exam, we find that all these variables have odds ratios of more than 1 which are statistically significant at 1 percent. It implies that, for every one unit increase in the given variables, there is a greater likelihood of the case falling in comparison category. In other words, greater the student's concentration level and content retention along with perceived usefulness of technology in previous exam, greater the satisfaction from e-learning for him. The rationale for the same is self-explanatory. Corollary for the above inference, we find that, Technical problems in online classes have an estimated odds ratio of less than 1. This means that for every one unit increase of the given variable the likelihood of the case falling in base reference category increases by a factor of 0.684 which was found to be statistically significant at 10 percent confidence interval. This means that satisfaction derived from e-learning among students is inversely proportional to technical problems.

When we observe per capita income of the families of students, we find that the corresponding odds ratio having value more than one is statistically significant at one percent. This implies that for every one unit increase of the given variable, there is a greater odd of the case falling into comparison category. This implies that students belonging to economically better off households find e -learning to be more useful for them as compared to students belonging to economically vulnerable category. This makes rational sense as, we have observed from chi square test that, students belonging to economically better off households had better access to personal computers, laptops and had self-ownership of the same as well. This is logically bound to enhance their satisfaction level from e-learning.

POLICY IMPLICATIONS

There is a radical shift happening in the teaching learning pedagogy from teacher-centric phase to student-centric learning in the world. COVID by necessitating imbibing of technology in academia by the community of teachers and students has acted as a catalyst in fastening the pace of this change. In this backdrop the study was undertaken whether teaching and learning community from both rural and urban India were ready to cope up with the new normal. In order to understand the same an effort was made to collect data from 638 respondents across 5 districts of Karnataka. The major policy implications of the study were as follows:

- The study reinforces the fact that urban-rural economic divide is still a bitter truth prevailing in the Indian economy. This is very well reflected in our study where in in per capita income of urban families was higher than per capita income of rural families. The economic divide is further corroborated by our study which further found that majority of advanced digital devices used for e-learning like laptop, tablet and personal computers were owned & used by urban students and rural students predominantly relied upon mobile for e-learning. From the above inference, it is recommended for the State Governments to provide subsidized or free digital learning devices for the student community, especially for students belonging to rural area. Although few of the states have already taken noteworthy steps in the following direction, our study underlines a greater focused effort is needed for students in rural areas as they are more vulnerable than their urban counterparts in accessing digital devices for the purpose of learning.
- Although the Government has taken several initiatives to bridge the gap between urban and rural socio-economic infrastructure, there is a visible requirement of ramping up the efforts. From our study we found out that, students in rural area are having more technical problems than students

in urban area with regards to using technology in e-learning process. The technical problems can be attributed to socio economic infrastructure. This resulted in a major hurdle for them in effectively utilizing digital devices for the purpose of e-learning. This has been further validated through our study, which found that students residing in rural areas had trouble in concentrating during virtual classes, had technical problems while using digital devices which all in all resulted in less than satisfactory e-learning outcomes for the students residing in rural areas. This effectively has undermined the e-learning effectiveness of rural students. So Central Government must ensure both quality and quantity of economic infrastructure like network coverage and electrical grids in rural areas at earnest.

CONCLUSION

In western world e-learning has revolutionized learning process from teacher-centric approach to student-centric approach. Many of the studies undertaken in the western world have time and again found that information communication technology enhances effectiveness and utility of learning among students. Although India was bit late in being part of internet revolution, fortunately or unfortunately COVID-19 has made the process of inculcation of technology a necessity in India. Both Central and State Governments have realized the importance and impact of student centric learning vis-à-vis teacher centric learning approach as has been experienced in the western world. Technology is great facilitator to encourage this process among teaching and learning community of our nation. In this context, it is the moral and ethical responsibility of Central and State Governments to take appropriate measures to facilitate the same. Our study highlighted few of the problems faced by rural student's vis-a vis urban students in effectively utilizing Information Communication Technology for e-learning, which could be addressed through policy interventions at right level. The ultimate aim of our study was not to criticize the noteworthy efforts which have already been undertaken at State and Central level, but the objective of our study was to mirror the ground realities so as to ensure that the policies can be relooked and revised so as to serve their rightful purpose in the most efficient manner. Hopefully our study has fulfilled its underlying objective.

Bibliography

Anu Sharma, Kapil Gandhar and Seema, (2011). Role of ICT in the Process of Teaching and Learning. *Journal of Education and Practice*, Vol.,2, No 5, pp.1-6.

Ari, Erkan (2016). Using Multinomial Logistic Regression to Examine the Relationship Between Children's Work Status and Demographic Characteristics,Volume 4, 77-93. *Research Journal of Politics, Economics and Management*

Buchanan, E.A. (1999). Assessment measures: Pretest for successful distance teaching and learning, *Journal of Distance Learning Administration* [Electronic], 2(4), Retrieved July 23, 2021 from http;//www.westga.edu/~distance/ buchanan24.htm

Peters, O. (2000). The flexible and virtual university: Pedagogical models. *Open and Distance Learning in The New Millenium*, IGNOU: New Delhi.
Selwyn, N. (2016). Is Technology Good for Education?, Wiley, Cambridge, ISBN: 978-0-745-69646-1

Milligan,W.W.(2010). Information Technology at Michigan Tech: 2010 Survey Results and Discussion.

Internet Society (2016). Mobile Internet Usage Trends in Asia-Pacific– APAC Bureau,9 Temasek Boulevard, #09-01 Suntec Tower 2, Singapore 038989 Retrieved July 07, 2021 from https://www.internetsociety.org/wpcontent/uploads/2017/08/Mobile20Internet20Usage20Trends20in20Asia-Pacific.pdf

Kumar, B. A., Goundar, M. S., & Chand, S. S. (2020). A framework for heuristic evaluation of mobile learning applications. Education and Information Technologies, https://doi.org/10.1007/s10639-020-10112-8

Malik, Manju (2001). Education Beyond 2000, Revolution in Education InformationTechnology. DAV Centenary Public School, Rohtak

Singh, H.(2003). Building Effective Blended Learning Programs. *Educational Technology*, Volume 43, Number 6 pp 51-54.

Haryani, H., Wan Faezah, A., & Nor Aini, A. R. (2012). The adoption of blended learning among Malaysian academicians. *Procedia - Social and Behavioral Sciences, 67*, 175–181. https://doi.org/10.1016/j.sbspro.2012.11.318

Here's how technology affects our life? (2018). *The Economic Times,* Retrieved February 12, 2021 from https://economictimes.indiatimes.com/tech/internet/heres-how-technology-affects-our-life/technology-addiction/slideshow/62497145.cms

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. Research in Learning Technology, 20(1), https://doi.org/10.3402/rlt.v20i0/14406

Nadaf, Dr-Zaffar (2017). Perception of Students on Tablet and Laptop Distribution Scheme of U.P. Government, *Educational, Cultural and Psychological Studies,* DOI:10.7358/ecps-2017-015-nada

UGC. (2020). UGC guidelines for re-opening the universities and colleges post lockdown due to COVID-19 Pandemic Retrieved August 10,2021 from https://www.ugc.ac.in/pdfnews/1360511_UGC-Guidelines-for-Re-opening-of-Universities-and-Colleges.pdf

UNESCO. (2020). COVID-19 a setback for education, governments must address inclusion challenges: UNESCO Report. Retrieved August 8, 2021 from https://www.ndtv.com/education/covid-19-setback-for-education-governmentsmust-address-inclusion-challenges-unesco-report

Marinoni, G.,Land,H.,& Jensen,T.(2020).Impact of Covid-19 on higher education all around the world. International Association of Universities. Retreived 21 June 2021 from www.iau-aiu.net/IAU-releasesGlobal-Survey

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