Harnessing Digital Revolution for Technical Academic Performance: Context to Rurban Segment

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Abstract: Information sharing through technology has always democratized education, recently enabling more students from various strata to access the same resources and tools hence bringing a revolutionary transformation worldwide. It empowers students to enhance and broaden their academic acumen, latest research area exploration and assignments to be submitted during their academic pursuits. The research investigates pedagogical impacts of low-tariff internet availability for technical undergraduate students enrolled in engineering field in urban vicinity and rural segments of Bihar. It assesses the role of online tutorials, wikis, blogs, tweets, feeds, videos on YouTube as educational nodes, their reach to Rural areas and their roles in enhancing the academic performance of the students. The study also considers the procrastination attitude towards studies as risk associated with Internet overuse. It evaluates whether anytime-anywhere Internet availability increases or decrements students' performance in urban areas and percentage uninterrupted accessibility of internet in engineering colleges of rural areas.

The methodology adopted was a cross sectional study conducted on Engineering pursuing students for three sessions 2011-14; 2013-2016 and 2015-2018 primarily to mark the exponential decrease in tariff upon the capacity of internet consumption in India. The online Questionnaire instrument was circulated to Alumni Connect platform for passed out students and ERP mode for current students of city based institution and face-to-face mode in rural organization. The CGPA of sampled students were recorded from Examination Department tabulations.

Dependency on internet for academic accolades were evaluated and tested for correlation with reference to gender, economic capacity, usage, course coverage for sampled 2200 students (State-Aided, Private and State Govt. Engg. Colleges).The statistical results portrayed that 71% of the respondents were hostel residents and accessed internet for multiple purposes. Around 79.2% were identified as using internet for classroom teaching supplements and 68.3% used for document downloads like quizzes, assignments. Internet Access of 6 -8 hours were observed to have higher CGPA with p = 0.011 probability value indicating that students with high internet usage with consistent speed improve upon their academic performance with higher grades.

Keywords: digital revolution, low tariff internet consumption, academic performance, statistical evaluation, correlation.

Introduction

The Indian government's slogan on *Digital Revolution* and *Digi-connect* with a vision to increase Information and Communication technology has resulted in initiatives to expand internet penetration. Internet has brought a revolutionary change in the information scenario with the world statistics proclaiming more than 2 billion internet users [13]. The usage of internet in school campus and society has been increased and it has become an important part of student life [9]. The students' digital connectivity and expertise has trended to become an important part of their world. Encouraging students to harness and propagate to others about digital skills can help them see across geographic barriers and the 4G speed connectivity has aided in this learning. If students' from all communities can balance technology gifts with focused attention and assertiveness to enhance their academic performance in all the subjects with anytime-anywhere availability of the internet, segment divide would cease in learning. Reports showed that 91% of adult internet users uses e-mail, 38% uses instant messaging and 35% uses social network site for communication with each other [10]. Advanced academics with research orientation to develop knowledge base of electronic theses and dissertations, technical reports, patents which are available online shall strengthen India as Digital Brain Power.

The rest of the paper is organized to contain the Related Literature review, Framework description. Section III outlines the experimental model and algorithm devised while Section V analyses the assessment criteria.

Related Literature Review

Many researchers have examined the influence of internet on students to broaden their academic knowledge and as a valuable source to retrieve information for their research and assignments. In year wise publication chronology:-

Hanauer et.al (2004) surveyed diverse community colleges to assess the use of the Internet by the students. The survey showed that 97 although all the students surveyed had free Internet access through their community college, only 97% of the students reported having access to the Internet. The survey showed that 83% of Internet users had access to Internet at their home and 51% of the respondents accessed the Internet at their college or library. 81% of the students reported to access the Internet most for college work and 80% for e-mail/chat.

Oladipo et. al (2008) found that less than 10% (46, n=272) of the total students from some of the Universities studied, use the Internet on a daily basis. It also revealed that about 40% of the total respondents (n=272) use it on a weekly basis. It was also found that the students have more access to the Internet in the Cybercafés (90.8%).

Aqil and Ahmad (2011) it was found that 47 (52.64%) users rated the utility of Internet based information services as average for their academic purposes, while 36 (39.56%) users rated the Internet as high. Moreover, 6 (6.59%) and 2 (2.19%) rated it as low and very low respectively.

Ogedebe (2012) in his study found that 79% of the respondents accepted that their academic performance has been improved by using the internet, while 13% believed otherwise, 8% made no response to that question. The study also revealed that 65% of the respondents were computer literate, while 29% were not, 6% of the respondents neglected the question. The study further revealed that 8% of the respondents believed that their GPA has been improved remarkably as a result of the internet, 6% agreed that their GPA has been declining, 28% responded that it aids them in preparing better for CA and semester examination while 22% were indifferent about the options and therefore did not respond.

Bankole et.al (2012) illustrated that 97.6% respondents had accessed the Internet, while the reasons for non use of Internet was lack of training on how to use, the high cost of Internet access, lack of computer literacy and lack of time. 66.1% accessed the Internet at cybercafés outside the University campuses, 30.4% within the University campuses and homes (19.5%).Students used the Internet for a variety of purposes which include for communication (90.6%), doing class assignments (43.5%), to update knowledge (32.9%) and to supplement lecture notes (27%). The students used the email to communicate mostly with their friends and family members (72.0%), and 40.1% indicated that they used it to communicate with their fellow students and colleagues and only 10% mentioned using Internet to communicate with their lecturers.

P. Srinivasaragavan (2014) elucidates the problems respondents usually encountered in the use of internet. the data ranked in decreasing order revealed that frequent loss of signal 77.77% (140); frequent power outage 73.33% (132); high cost of browsing 66.66% (120); slow internet connection/access speed 55.55% (100); difficulty in judging relevant information 55.55% (100); taking long time to view or download web pages 55.55% (100) and information overload 55.55% (100); inadequate number of cybercafés (22.22%) (40) and inadequate browsing skills (11.11%) (20) were factors limiting respondent's use of internet.

Finally, to the best of the authors' survey, limited comparison work has been done to note the outreach of low cost internet in both urban and rural educational segments.

Table 1 : Emphasis Results observed by Researchers on Internet Parameters and effects

Research Work	Academic Purpose Utilization	Speed Determinant	Access tariff	Students' Performance
Khan et al. [9]	78%	80%	..NA..	83%
P. Srinivasaragavan [15]	89%	56%	67%	88.30%
Udende .P[16]	58%	NA	NA	35%
Manzoor [11]	95%	88%	65%	89%
Ogedebe [13]	65%	22%	29%	79%
Our Study	**94%**	**65%**	**86%**	**91%**

Problem Statement and Context of Study

Academic achievement of students is an interesting research area as a parameter in measuring success. To proliferate education for national development of the country, internet availability with high speed and low cost is a major asset. The study was conducted particularly to evaluate the impact of internet usage for studying on technical university students' academic performance in Bihar, India.

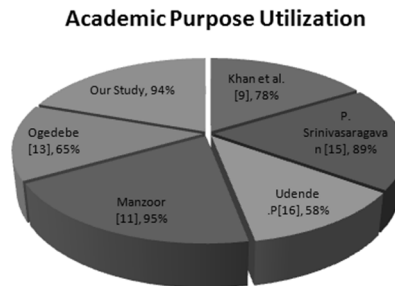**Academic Purpose Utilization**

Figure 1 : Comparison of Research Work on Internet usage for Academic Purposes

Table 2 : Research study Objectives to be Researchers on Internet Parameters and effects

Hypothesis Index	Problem Statement	Hypothesis Statement
H_{A1}	Can the Internet supplement classroom teaching?	There is no significant relationship between Internet as a supplement and students academic performance.
H_{A2}	Can usage of ICT generate interest among students of rural segments to excel in studies with internet as aid.	There is no significant relationship between rural origin students' perception of internet as aid and their academic performance.
H_{A3}	Is the internet a vital instrument for uplifting grades as sign of higher academic excellence?	There is no significant relationship between internet and grade upliftment in academic performance.
H_{A4}	Does CGPA have a significant correlation with internet tariff ?	There is no significant relationship between internet tariff as an access barrier and students' academic performance.

Methodology, Methods and Tools of Study

The cross sectional study was conducted using an online questionnaire for 1050 students registered at Govt. aided institute of Patna for three sessions 2011-14; 2013-2016 and 2015-2018; 650 students from Private college and 500 students from State Govt. college. The sections contained Demographic data on gender, age group and residency followed by section of educational interest and internet availability and its role on increase or decrease in GPA.

The online Questionnaire instrument was circulated to Alumni Connect platform for passed out students and ERP mode for current students of city based institution and face-to-face mode in rural organization. The CGPA of sampled pass out students were recorded from Examination Department tabulations.

The following assumptions were made for the study:-

- All the variables under study were measurable.
- The sample taken for the study by Slovin's formula was true representative of the entire population.
- The instrument (questionnaire) formulated for data collection was valid and reliable and fully comprehended by the respondents.

The sample space consists of four central government, 13 government engineering colleges in the public sector, 17 engineering colleges in the private sector and 2 government-aided technical institutes with an intake of approx. 9000. Since Central government institutes are well-equipped with technology so the sample was taken from State Govt-aided with seven disciplines in engineering, State Govt. college situated on the outskirts of Rohtas district with four streams of engineering and a Private engineering institute affiliated to AKU with five engineering disciplines.
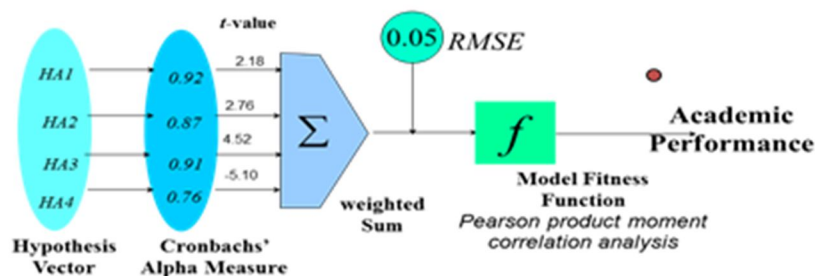

Figure 2 :- Fitness Model to Analyze Impact of Digital Revolution on Academic Performance

The research's questionnaire was developed from a synthesis about the adoption of internet in Academics. The constructs and items that used to assess each variable are summarized and analyzed in the section below.

Pearson's sample correlation coefficient

$$r_{xy} = \sum_{i=1}^{n}\left(X_i - \overline{X_i}\right)\left(Y_i - \overline{Y_i}\right)/(n-1)S_x S_y \ldots\ldots\ldots\ldots\ldots \text{(i)}$$

A comprehensive assessment of model performance comprises the Root Mean Square Error (RMSE) and the Nash–Sutcliffe Coefficient of Efficiency (NCE). They are respectively formulated as :-

$$RMSE = \sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(f_i - O_i\right)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(ii)}$$

$$NCE = 1 - \frac{\sum_{i=1}^{m}\left(f_i - O_i\right)^2}{\sum_{i=1}^{m}\left(f_i - M_i\right)^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(iii)}$$

where m is the number of observations; f_i stands for the forecasted parameteric value; O_i is the observed data values; M_i denotes the mean/ average observed va;ues . NCE =1 is a perfect fit.
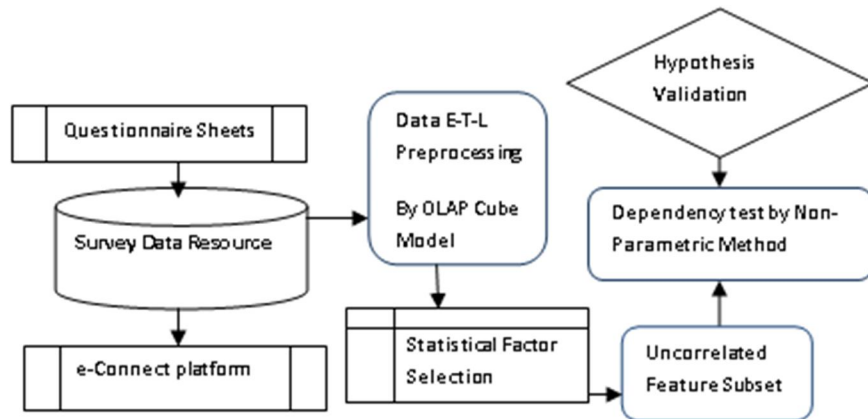

Figure 3 :- Model framework for Impact of Digital Revolution on Academic Performance

Results and Data Analysis

The 6A's Data analysis was performed namely Availability, Accessibility, Affordability, Acceptability and Appropriateness. "Availability of internet and Accessibility of its usage at Affordable rates among students with its Appropriateness as an aid to studies is considered for its Acceptability". The respondents featuring were 71.36% male and 28.63% female students. Out of these 69.13% were residing in campus hostels and remaining 30.86% were day scholars as depicted in figure 4. They were asked to specify the average number of hours spent on internet surfing and it was observed that with lower tariff rates of internet and the vast amount of data resources available over the internet; 5-6 hours of internet usage was recorded by 25% of the respondents during College days and 34% of respondents accessed 6-8 hours during weekends. 8-10 hours were spent by 22% over the net majorly during holidays.

Fig 6 shows that majority of respondents (79.2%) browsed the Internet for information supplementing their coursework and assignments, while 76% of the respondents were simultaneously browsing the internet at reduced cost for entertainment purposes.

The students respond 'I use internet because it yields relevant, fast results on the topics I search.

The interview described internet is rural segments as 'more accessible than printed books'. This qualitatively certifies the reliability of speed and outreach enhancement with reduced internet access cost.

Regression results point out that, previous and current grades followed by Internet usage are the most influential parameters for Academic level of s-shaped growth. The R square value = 0.802. The value indicates the appropriateness of this model for the data set at hand.
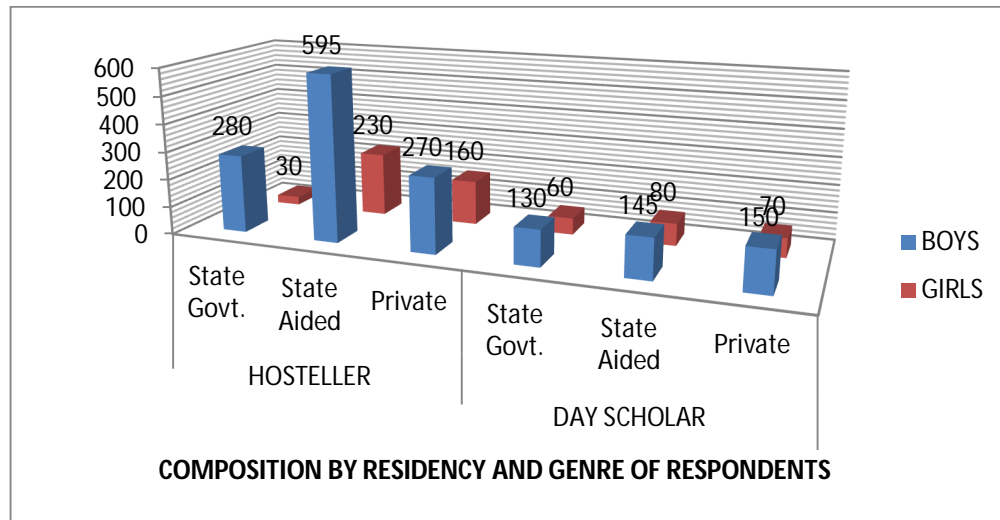
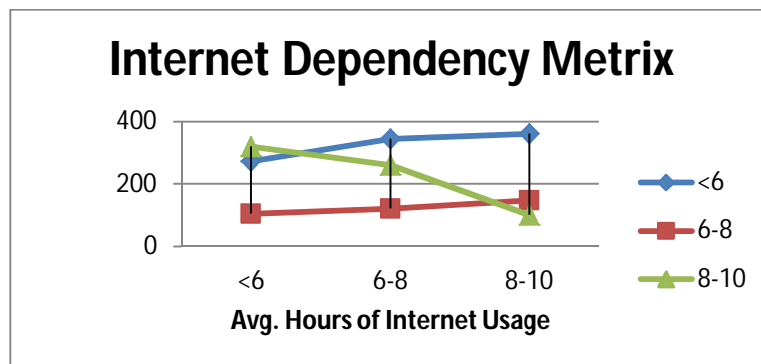Figure 4 :- Frequency of Respondents by Gender and Residence_Location

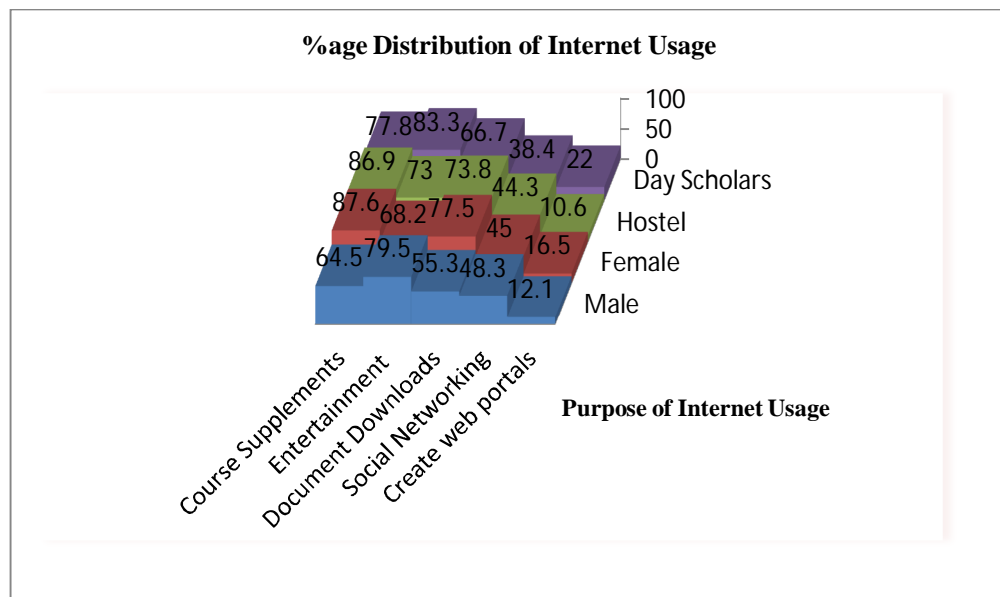Figure 5 :- Metrics depicting Low tariff Internet Usage in hours by the respondents

Figure 6 :- Impact of internet usage towards course supplements and document downloads for enhancing academic acumen
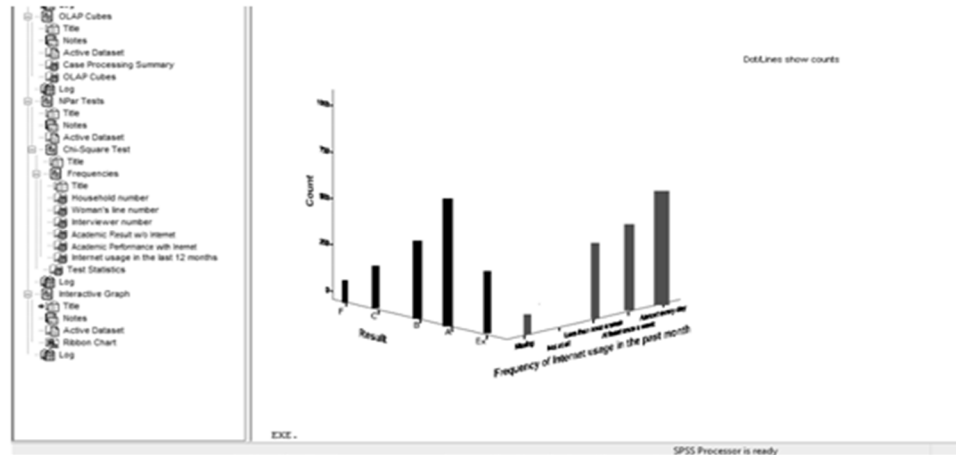
Figure 7 :- OLAP Cube Modelling Simulation for Frequency of Internet access and impact on Academic Grade Enhancement

Table 3 :- Non-Parametric Test for Statistical Dependency of Instrument Variables

Test Statistics						
	Study_Location	Income_Level	Internet_Usage	Prev_Grades	Current_Grades	Internet Tariff
Chi-Square a,b	396.16	50261.85	4090.069	313.5	384.66	172.86
Df	4	4	3	2	2	1
Asymp. Sig.	.000	.000	.000	.000	.000	.000

a.1 cells (12.5%) have expected frequencies less than 5. The minimum expected cell frequency is 252.2
b. 2 cells (25%) have expected frequencies less than 5. The minimum expected cell frequency is 1494

Source : Questionnaire

Table 3:- Regression Results for the Academic Level Measure

Regression Coefficients					
Model_Feature	β	Std_err	Cronbach's α	t-value	Significance
Study_Location	-0.337	0.102	0.92	5.902	.000
Income_Level	0.152	0.055	0.67	-8.059	.000
Internet_Usage	0.565	0.004	0.81	5.423	.000
Prev_Grades	0.016	0.001	0.78	3.721	.000
Current_Grades	0.008	0.006	0.86	2.036	.000
Internet Tariff	0.065	0.02	0.76	0.119	.000

Table 4:- Hypothesis Evaluation Significance Result (HA1,HA3 vary Significantly while HA2,HA4 are Accepted)

POST-HOC ANALYSIS (N= 2200)

Hypothesis Evaluation	Mean ± SD	t- Test	p- Value	Significance Result	Ho Result
HA1	3.97 ± 0.35	6.73	0.041	Significant	Rejected
HA2	23.45± 0.71	0.44	0.667	Not Significant	Accepted
HA3	3.10 ± 0.27	1.92	0.011	Significant	Rejected
HA4	7.88 ± 0.25	-0.19	0.092	Not Significant	Accepted

Conclusion and Future Enhancements

Four main hypotheses were formulated to guide the study, which were subjected to testing of 0.05 alpha level of significance with critical initial values and degrees of freedom.

Based on the findings it was concluded that the access to internet had a as a significant effect as a supplement to classroom teaching (p= 0.041) thus enabling Digital connect through online materials.

Significant relationship was observed between CGPA and Internet usage (p = 0.011). However, there was no significant relationship between CGPA and the tariff directly (p =0.092). There was a positive correlation between location of Study (Rural/Urban) and internet usage. Thus, it was concluded that academic achievements can be enhanced significantly (94%) by new initiatives in making internet accessible to remotest locations.

It is widely recommended that Curriculum planners in accordance with Government schemes should make internet available with secured connection for all technical institutes in the state and in the country.

The research can be further validated for multiple segments of the country and a KDD Intelligence platform can be created to predict the grades of the respondents ascertaining the reliability of the present finding.

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