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Assessment of Availability and Use of Technology by Students for Online Education during COVID -19 Pandemic in Rural India: A Case Study

Abstract

The sudden outbreak of the coronavirus and the consequent precautionary measures has compelled education systems worldwide to find alternatives to physical teaching-learning process. While online education is perhaps a ‘blessing in disguise’ in many ways, it has also exposed various challenges especially in the rural areas where people are struggling to get proper bandwidth and even uninterrupted electric supply. The lack of technological infrastructure has made it difficult for many students to adapt to learning in the new normal. Given to the situation, the aim of this study was to investigate the availability and use of technology for online education by undergraduate students of a college situated in rural India. A Survey was carried out to collect the required data and responses from students of the college under study were sought through a structured questionnaire. Out of 1788 students, 678 responded to the survey which formed the data sets for the study. The findings revealed that before the COVID-19 pandemic, Information and Communication Technology was used infrequently, however after the outbreak of the coronavirus following the shutdown of educational institutions, the situation changed dramatically and majority of students started using the technology on a daily basis to cope with need of the hour. The unprecedented situation brought numerous challenges to the fore and technological issues and limitations among others were frequently experienced by the students. Based on the findings suggestions are provided to enhance the efficacy and accessibility of technology supported education post COVID-19 pandemic.

Key Words: Remote Learning, Online Education, Digital Divide, Digital Information Literacy, Learning During Pandemic, COVID – 19, ICT

1. Introduction

In the past few decades there has been a revolution in the Information and Communication Technology (ICT) and it has had a great impact on numerous domains of society. Considering the potential of ICT with a view to transform the nation into a digitally empowered society and knowledge economy, many initiatives were also taken under the

Digital India campaign which was launched by the Government of India on 1st July, 2015. Eventually technology was changing the way people live and work even in pre pandemic period. But its impact has been felt much more comprehensively in the past one year during the COVID – 19 pandemic. While technology has great potentials in the growth and development of a country, education can play a critical role in this transformation. To quote Nelson Mandela “Education is the most powerful weapon which you can use to change the world”. Undoubtedly technology enabled teaching and learning is pivotal not only in the improvement of educational processes but also it makes significant impact on the outcomes. Although technology integrated education was not a totally new concept, its use for teaching and learning was remained a challenge for developing countries like India. Given to the advancements in digital technologies and its potentials in improving the quality and accessibility of Higher Education to large part of students across the country many efforts were taken at national level under the National Mission on Education such as Swayam, Swayam-Prabha, National Digital Library, e-Yantra, Virtual Lab and many others (www.nmeict.ac.in). Though many educational institutions were way ahead in the journey and had been providing digital infrastructure and solutions to their clientele in best possible ways, use of technology in the classroom was not significant and hence technology enabled teaching and learning seemed a distant reality until a few years ago in India.

The shutdown of educational institutions as a precautionary measure to contain the spread of coronavirus during the early period of the pandemic, forced the stakeholders to contemplate on online classes to keep the learning going. The complete transition to online mode virtually overnight during the early stage of pandemic perceptible in India was a commendable move to ensure continuity in education without a break. With a view to address the need of the education system, The Government of India also announced numerous e-learning projects and initiatives and strengthened the already existing digital initiatives as viable solutions to provide unhindered education to students. (cec.nic.in/cec/),(www.inflibnet.ac.in/activities/), (ndl.iitkgp.ac.in/), (swayam.gov.in/).

For the Indian education system, moving towards online teaching and learning was a paradigm shift in the domain. Evidently the otherwise challenging coronavirus impelled ICT into the spotlight as, a wave of e-learning platforms, tools and hardware solutions all aimed at supporting and enhancing remote learning rapidly emerged and gained popularity. As the dependency on technology increased, the fundamental question arose on the access to internet

and device ownership by the students especially in rural India as many previous studies have highlighted the prevalence of numerous dimensions of digital divide in India. (Asrani, 2021) (Dutta, 2020) (S. Singh, 2010) (N. Singh et al., 2013) (Panda et al., 2013).

Even many government reports evinced the existence of digital divide in India. As per the report of NSS 75th round (July 2017 – June 2018) based on the data collected by the National Sample Survey as a part of the survey on household social consumption on education in India, nearly 24% of the households had access to internet in the survey year 2017-18. There was a significant urban-rural divide also visible where the proportions were 42% among urban households and 15% among rural households (Government of India, 2019). As per the quarterly report of the Telecom Regulatory Authority of India (TRAI) for the quarter ending 30th June, 2020, published on 9th November, 2020, in India number of total internet subscribers per 100 populations was 98.35 and 33 in urban and rural areas respectively (www.trai.gov.in). Given the situation, this does not augur well for holding online classes for students of rural India. Hence policy makers and educators need to look into the aspect to determine the ways to address the need of the stakeholders and serve society in the future.

2. Review of Literature

Digital divide in education is ubiquitous and evidently considerable numbers of studies from different part of the globe have focused the aspect. Olayemi and others through a study investigated the perception and readiness of students' towards online learning in Nigeria during the COVID-19 pandemic. The required data was collected through a structured questionnaire. The study reported that majority of the respondents indicated high level of ICTs skills and competencies needed for online learning. The study also revealed that fear of high cost of data, poor internet services, erratic power supply, inaccessibility to online library resources and limited access to computer were the major perceived challenges to effective online learning (Olayemi et al., 2021). Asrani carried out a study on ICT adoption and its use capabilities in India and found that the adoption of ICT in India has been rapid since the year 2000, however the study found many disparities across the country. It reported that income, education and household demographics are strong determinants of ICT adoption and education, age, gender are the main factors for variations in an individual's ICT use capabilities (Asrani, 2021). Adejo studied the availability and utilization of Information and Communication Technology (ICT) facilities for services in Nigeria French language village library through a descriptive survey. The findings revealed that ICT facilities are only used

for operational services in the area of acquisition, reprographic services and selective dissemination of information service (Adejo, 2021). Dutta has reported digital divide as a macro problem in the economic sense. The study argued that though digital inclusion pushes an economy forward, it has some backward effects as well and it is more intense in developing countries like India rather than the developed countries. The study highlighted multiple factors like age, gender, race, ethnicity, income, education, place of residence, attitude of people, household size, etc. as the determinants responsible for creating digital divide (Dutta, 2020). Elena-Bucea and others have assessed the digital divide between and within the 28 member-states of the European Union based on four socio-demographic contexts i.e. age, education, gender, and income. Data for analysis was considered for a particular period of time. Given to the digital divide's complexity, a multivariate approach was applied i.e. factor analysis with oblique rotation, which resulted in two distinct dimensions: e-Services and Social Networks. The study reported that the main drivers for digital divide in e-Services are mainly education and age. While e-service adoption was influenced mainly by the education level of individuals, adoption of social networks was primarily affected by the age of the individuals (Elena-Bucea et al., 2020). Singh and others have focused on an alternative policy approach to bridging the digital divide, through organisational innovations that provide low cost internet access in rural India. For the study, survey method was used and data from 500 individuals consisting of four states of India namely Haryana, Madhya Pradesh, Punjab and Rajasthan was collected to examine factors influencing patterns of computer and internet use (Singh et al., 2013).

3. Objectives

The primary objective of this study is to understand the availability and use of technologies by the undergraduate students of Lokmanya Tilak Mahavidyalaya keeping in view to address their needs in post pandemic period. To understand this, following objectives are set.

- To find out the availability of technology for students including the types of devices and connection of internet at home.
- To know the purpose and frequency of use of technology.
- To identify the barriers students faced in accessing technologies during online learning.

- To understand the challenges that students faced to continue learning during the pandemic.

4. Scope and Limitations

The study is restricted with the undergraduate students of Lokmanya Tilak Mahavidyalaya which is situated in the Wani tehsil (town) of Yavatmal district in the Indian state of Maharashtra. It is a NAAC (National Assessment and Accreditation Council) accredited college established in the year 1961 which runs various Arts, Commerce and Science courses ranging from higher secondary to post graduation with around four thousand students. The study is not free from limitation. As the study is restricted with a small number of students mainly belonging to a particular area, generalization of the findings without additional research will not be free from flaws. However, this study will definitely provide valuable insight into the prevalent situation and may serve as a call to action for authorities and academic communities leading to dedicated efforts in bridging digital divide (if any) in the country.

5. Methodology

The targeted population for this study comprised all undergraduate students belonging to the selected college. A questionnaire was designed by the researchers to obtain the data needed for the study which include questions on respondents' demographic information, access to technology, use of technology, use of subject gateways and portals initiated by the government for education and the challenges encountered by the students. The questionnaire was prepared using Google form and the link was circulated through Google class room and WhatsApp groups of students. Responses were collected during 17 February to 26 March 2021. Out of the 1788 population, 678 responses were received from the students after best possible efforts. Hence the study is based on these 37.91% responses. Simple arithmetic and statistical methods are used for the analysis of the data.

6. Analysis and Interpretation

6.1. Profile of respondents

6.1.1. Gender wise and faculty wise breakup of respondents

Of the total 678 study participants, 218(32.15%) are from Arts, 201(29.65%) are from Commerce and 259(38.20%) are from Science faculty. The total respondents consisted of

194(28.61%) males and 484 (71.39%) females. The gender wise breakup of the total 678 respondents included 65(29.82%) males and 153 (70.18%) females from Arts, 54 (26.87%) males, and 147 (73.13%) females from Commerce, 75 (28.96%) males and 184 (71.04%) female students from science faculty. The distribution of respondents is given in Figure 1.

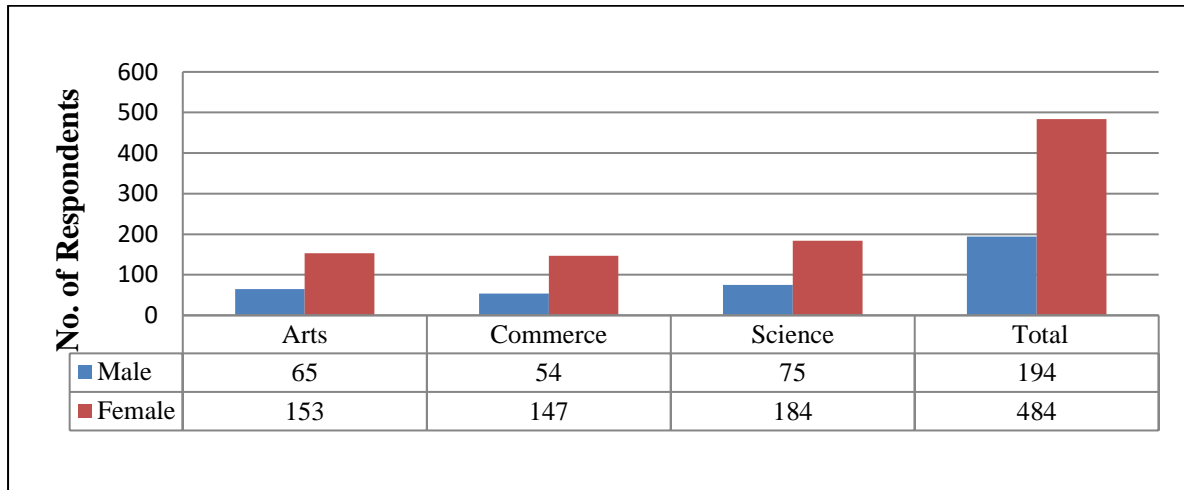


Figure 1: Gender wise and faculty wise breakup of respondents

6.1.2 Distribution of respondents across faculties and year of study

Table 1: Distribution of respondents across faculties and year of study

Year of Study	Faculties			Total
	Arts	Commerce	Science	
1st Year	97	71	85	253
2nd Year	79	61	75	215
3rd Year	42	69	99	210
Total →	218	201	259	678

As shown in table 1, of the total respondents, highest number of participants 253(37.32%) are from 1st year followed by 215(31.71%) from second year and 210(30.97%) are 3rd year students of three year bachelor degree course.

6.1.3 Distribution of respondents based on annual income of family

Table 2 displays the distribution of respondents based on annual income of their families. It can be seen from the table that majority of the respondents (616 : 90.86%) are from the lowest bracket of income i.e less than 2.5 lakh rupees per annum while a meagre percentage of respondents (9 : 1.33%) are from the above 7.5 lakh rupees income bracket.

Table 2: Distribution of respondents based on annual income of family

Income Slab (in ₹)	No. of respondents	Percentage
Less than 2 .5 lakh	616	90.86
2.5 to 5 lakh	38	5.60
5 lakh to 7 .5 lakh	15	2.21
Above 7.5 lakh	9	1.33
Total →	678	100.00

6.2. Access to technology

6.2.1 Access to computer/ digital device

Responses from the students were collected on two aspects to understand the availability of technology to them for continuing their learning during pandemic, firstly the access to computer and secondly, the internet facility. For this study, a computer included devices like, desktop computer, laptop computer, notebook, netbook, palmtop, tablet (or similar handheld devices) and smart phone. The purpose was to find out the availability of digital devices at their home to use the internet.

Table 3 : Access to computer/ digital device

Type of device	No. of respondents	Percentage
Desktop computer	125	18.44
Laptop computer	32	4.72
Notebook	0	0.00
Netbook	0	0.00
Palmtop	0	0.00
Tablet (or similar handheld devices)	6	0.88
Smart phone	643	94.84
Total →	806	118.88

Note - (Multiple options were allowed)

Table 3 depicts the percentage of respondents having computer/digital device at home. The figures are quite stimulating in the transit phase of education, as all the students have at least access to technology. However it is not clear that whether they own the device or using by sharing. It is found that maximum number of students (94.84%) have mobile phones and that must have the preferred medium for teaching-learning during the COVID-19 period. About 18% of the students have Desktop computer available in the house followed by Laptop Computer (4.72%). Tablet (or Similar Handheld Devices) is the least available devices with the students for the online learning in the pandemic period.

6.2.2 Access to internet across income slab

Table 4 portray students' access to a digital device and internet at home with their families' annual income. It can be seen from the table that though all the respondents have access to digital device at home, internet connection at home is influenced with their family income. Of the total respondents, 19.32% students still do not have internet access at home. While 100% students from the two upper income slab are having internet access at home, 20.29% students from the income slab 'Less than 2 .5 lakh' and 15.79% students from the income slab '2.5 to 5 lakh' still do not have internet access at home.

Table 4: Respondents' access to technology at home and their family income

Income Slab per Annum (in ₹)	No. of respondents	Having computer at home (%)	Having internet at home (%)	Not having internet at home (%)
Less than 2 .5 lakh	616	616 (100)	491 (79.71)	125 (20.29)
2.5 to 5 lakh	38	38 (100)	32 (84.21)	6 (15.79)
5 lakh to 7 .5 lakh	15	15 (100)	15 (100)	0 (0.00)
Above 7.5 lakh	9	9 (100)	9 (100)	0 (0.00)
Total →	678	678 (100)	547 (80.68)	131 (19.32)

6.2.3 Period of Access to internet

As can be seen from table 5, highest number of households i.e. 297(43.81%) subscribed the internet during lockdown only when there was no other option to keep the learning of their children going. Only 36.87% (250) households had the facility at home even in pre pandemic period while 19.32% (131) of the respondents still don't have internet even after almost one year of beginning of online classes.

Table 5 : period of subscription to internet service at home

Period	No. of Respondents	Percentage
Before lockdown	250	36.87
During lockdown	297	43.81
Still don't have access to internet at home	131	19.32
Total →	678	100.00

Table 6 : Reason behind not having internet connection at home before lockdown

Indicators	No. of respondents	Percentage
Financial constraints	195	45.56
Need was not much	101	23.60
Sufficient access at college	78	18.22
It's a distraction to studies	39	9.12
No network in the area	15	3.50
Total →	428	100

Table 6 presents five indicators that provide an overview of main reasons to the non availability of internet at home. The study sought to obtain information on participants' opinion about not having internet connection at home before lockdown. As reported by students the main reasons for not having access to the Internet at home was that the access was too expensive (195: 45.56%) and that their need was not much in the traditional method of teaching (101: 23.60%). Sufficient access to internet at college was another reason for not feeling the need of internet connection at home (78: 18.22%). The findings reveal that 9.12% (39) students consider internet at home was a distraction to studies while 3.5% (15) students reported that lack of network was the reason behind not having the internet connection at home before lockdown.

6.3. Internet subscription, expenses and use

Questions were asked to find out the type of internet connection students are having, popular Internet Service Providers (ISPs) and expenses towards the facility, the bandwidth and the satisfaction level of the students, time spent on the internet and the alternate ways of access by those who does not have the connection at home. The purpose of these questions were to understand the digital infrastructural developments of that area and feasibility of adoption of blended learning which seems to be the new normal in the educational arena post pandemic. As per the responses of the students, the preferred way to access the internet is through Mobile Wireless (388/547: 70.94%) while 9.88% (54/547) students were not sure about the type of service they were availing. Private Internet Service Providers are more popular in the area as, Reliance Jio Infocomm Ltd was found to be the first preference (60.91%) whereas a meagre 2.06% users are having services from Bharat Sanchar Nigam Ltd. (BSNL). In regard to the cost of the internet, 38.79% students have reported that they are paying more than Rs 200.00 per month towards internet which is quite a high amount as maximum of them belongs to the lower economic strata. The bandwidth is also an area of concern as, almost

half (50.59%) of the students have reported that they were somehow satisfied with the speed of the internet. While majority of the students (71.53%) students access the internet at home through their own device some students (6.78%, 5.60%) though the percentage is comparatively low, depend on friends/ relatives and other possible sources for internet facility to keep pace with the online teaching during lockdown. All the students surveyed access the web daily of which 34.96% connect to the internet for 1-2 hours, followed by 22.27% students who use the net for 2-3 hours. A small percentage of students (11.21%) engage with the web for more than 4 hours a day.

6.4. The purpose and frequency of use of internet

Table 7: The purpose and frequency of use of internet

S.N.	Purpose of use of internet	3 = Daily, 2 = Occasionally, 1 = Never					
		3	%	2	%	1	%
1	Curricular (Attending online classes, appearing online exam. etc)	490	72.27%	78	11.50%	110	16.23%
2	Co-curricular (Preparation of charts, projects, essay writing etc.)	155	22.86%	352	51.92%	171	25.22%
3	Attending online short-term courses conducted by the college	271	39.97%	220	32.45%	187	27.58%
4	Visiting portals and subject gateways introduced by the Govt. (e.g.Vidyamitra, CEC YouTube channel, NDL etc)	170	25.08%	286	42.18%	222	32.74%
5	Preparation of competitive exam.	313	46.17%	188	27.73%	177	26.10%
6	Reading e-Newspaper	326	48.09%	174	25.66%	178	26.25%
7	Checking the updates on COVID-19 pandemics	238	35.10%	245	36.14%	195	28.76%
8	Checking the university notifications	322	47.49%	188	27.73%	168	24.78%
9	Attending webinars	162	23.89%	270	39.82%	246	36.29%
10	Social networking sites (e.g.Facebook, Twitter, MySpace etc)	274	40.41%	219	32.30%	185	27.29%
11	Online shopping	25	3.69%	228	33.63%	425	62.68%
12	Entertainment (Watching movie, web series etc)	147	21.68%	286	42.18%	245	36.14%
13	For payment of electricity bills, rents etc	8	1.18%	196	28.91%	474	69.91%
14	Internet Banking	34	5.01%	256	37.76%	388	57.23%
15	Booking of tickets, LPG cylinder etc.	0	0.00%	178	26.25%	500	73.75%

The past decades have witnessed remarkable growth in the capabilities and reach of Information and Communication Technologies (ICTs) across the globe. The Internet, especially, has immense potential in enhancing the educational process and outcome.

However the use of technology varies from generation to generation as different generations attributes different values to various technological solutions. To understand the digital behaviour of the millennial generation undergraduate students, questions related to use of internet for general as well as academic purposes were asked and the responses were collected based on a three parameter scale (daily, occasionally, never). The responses are depicted in Table 7 and Figure 2.

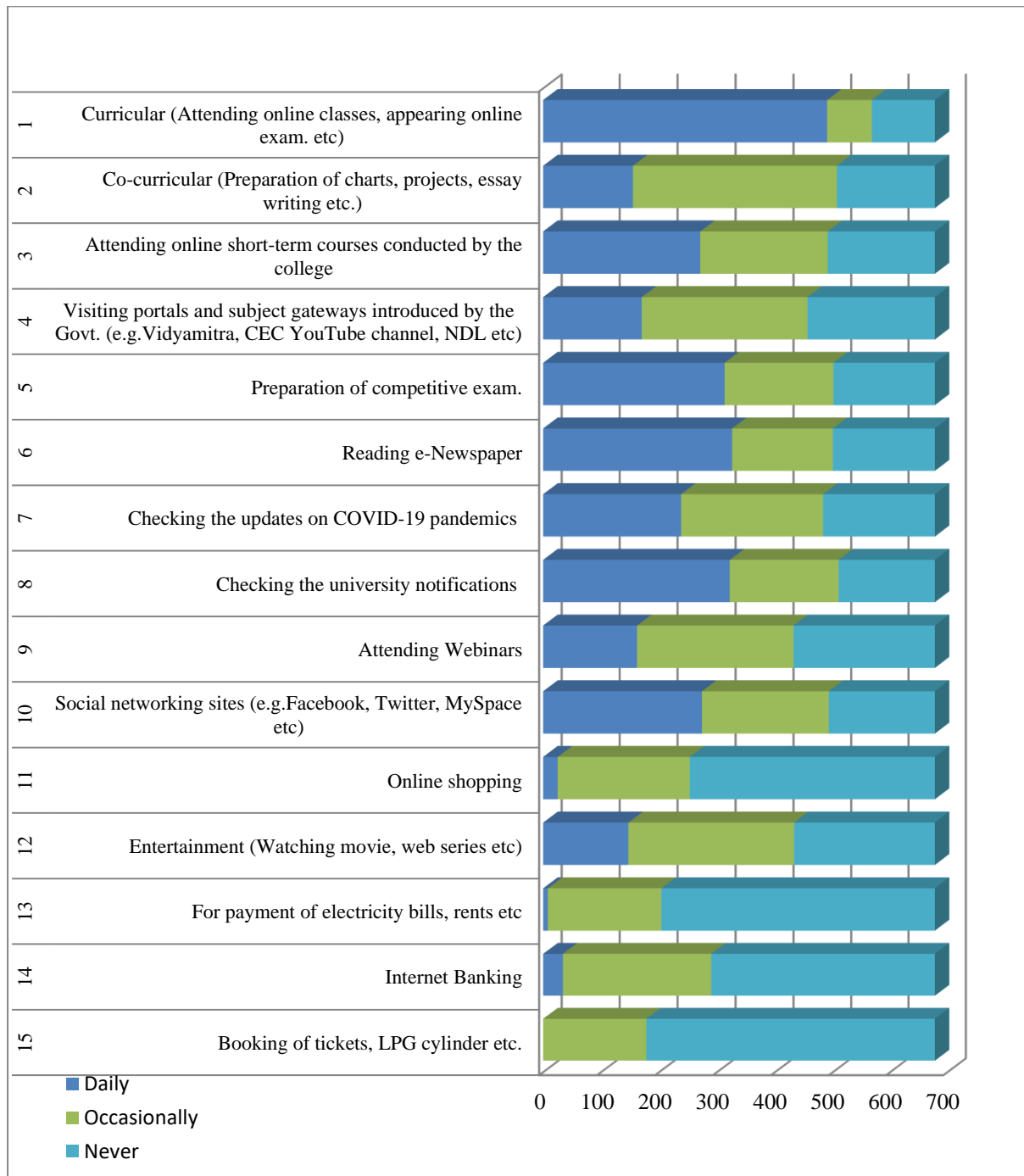


Figure 2: The purpose and frequency of use of internet

Out of the fifteen questions included in this section, nine questions were focussed on the academic activities while six were related to general purposes including entertainment, social networking and household requirements. The responses submitted showed significant differences across all the questions. It is found that students have used the Internet extensively for educational purposes with more than 70 percent used the technology for curricular purposes. However, they were less frequently used it for house hold works. For social communication and entertainment a modest percentage of students (about 40% and 22% respectively) have engaged with the web daily. It proves that many students see the internet as a space to communicate with friends and family rather than a platform for learning resource. For the preparation of competitive examinations, reading e-newspaper and checking the university notifications almost 50% students have used the internet on daily basis. Visiting portals and subject gateways introduced by the Government witnessed a low response as only 25% students are daily users of these sites while about 33% students have never been visited these sites.

6.5. Use of subject gateways and portals

Responses on the use of subject gateways and portals are depicted in Table 8 and Figure 3. Across questions that ascertained use of subject gateways and portals initiated by the government for education during shutdown of college, the average score of the participants who have used the portals found to be 39.46% while 60.54% students have not visited these sites for their study purpose during the remote learning period. Of all the initiatives CEC YouTube channel found to be more popularly used by the students (56.93%) followed by VYAS channel (49.71%). National Digital Library, the virtual repository which is rich in volume and variety of learning resources found to be used by only 46.02% students. Even the usage of N-List, the subscribed e-resources are found to be very low. The findings suggest there is a need of orientation program to make the students aware about the various Open Educational Resources to enable successful implementation and use of these initiatives.

Table 8 : Use of subject gateways and portals

S.N.	Subject Gateways / Portal	Yes	%	No	%
1	Swayam (Indian MOOC platform)	179	26.40%	499	73.60%
2	Swayam Prabha (free DTH channel for education)	223	32.89%	455	67.11%
3	VYAS channel (initiative by CEC to keep learning 24X7)	337	49.71%	341	50.29%
4	CEC YouTube channel (e-Content courseware in UG subjects)	386	56.93%	292	43.07%
5	Infoport (subject gateway)	235	34.66%	443	65.34%

6	Vidya-Mitra (online learning portal)	278	41.00%	400	59.00%
7	Today in history (everyday learning by CEC)	307	45.28%	371	54.72%
8	National Digital Library	312	46.02%	366	53.98%
9	N-List	151	22.27%	527	77.73%

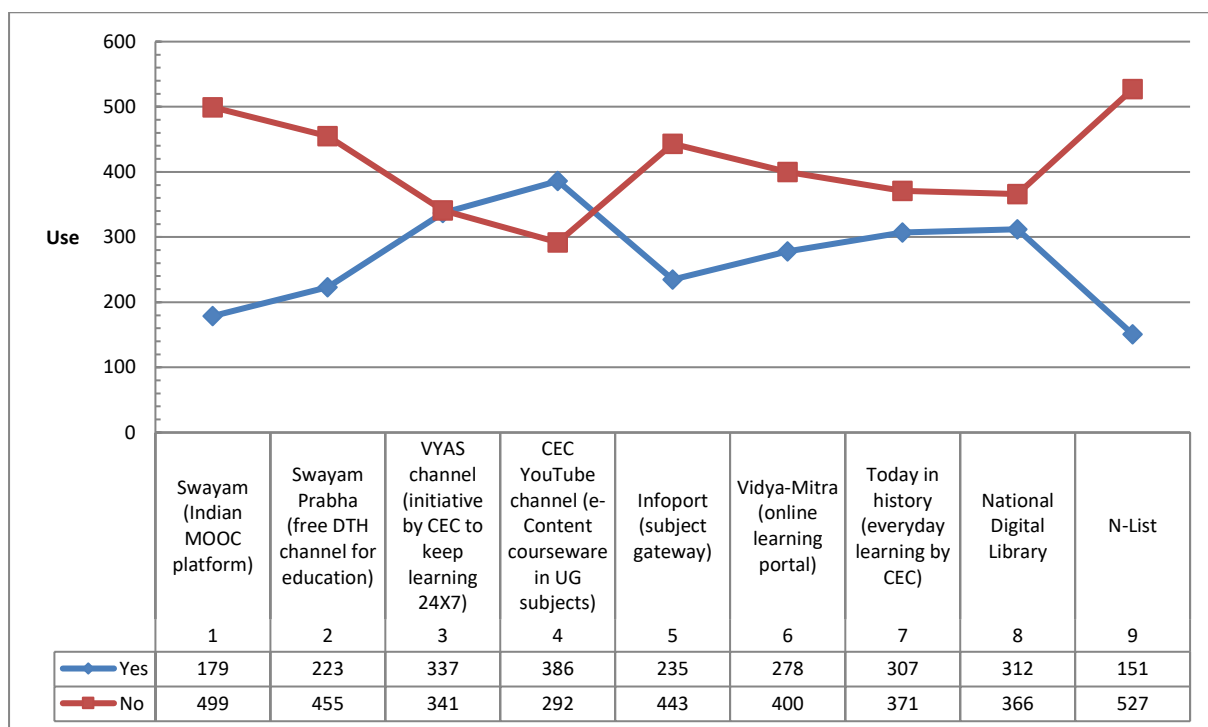


Figure 3: Use of subject gateways and portals

6.6. Challenges in adopting technology for education

To understand the difficulties of students while learning remotely, ten questions were asked focusing the potential challenges students would have encountered. Based on a four parameter scale (Always, Occasionally, Rarely, Never) the responses were recorded. Table 9, Figure 4 and 5 illustrate the analysis of the responses recorded. It is found that the overall mean of the challenges students faced is 2.76. While average mean of four out of ten dimensions are almost nearer to the overall mean while one dimension i.e. low speed internet had registered high variation (mean – 3.11) which proves that the frequency of the confrontation with this challenge is high in comparison to others. Non availability of devices also found to be frequently occurred (mean - 2.81) which indicates that ownership of device is low and in majority of households devices are shared by the family members. Responses against information browsing skill and awareness about reliable subject gateways /portals

both recorded lowest average mean (2.61) which indicates that majority of students have reasonable level of digital skills. The value of co-efficient of variation which ranges from 0.28 to 0.40 also proves a low variance level.

Table 9 : Types of challenges and its frequencies

S. N.	Types of Challenges	4 - Always, 3 - Occasionally, 2 - Rarely, 1 – Never							
		4	3	2	1	Total	Mean	SD	CV
1	Non availability of device for internet access	203	221	178	76	678	2.81	0.99	0.35
2	Low speed of internet	278	220	154	26	678	3.11	0.88	0.28
3	Insufficient material in language of choice	177	227	173	101	678	2.71	1.01	0.37
4	Selecting appropriate Information due to information overload	192	223	180	83	678	2.77	0.99	0.36
5	Difficulty in evaluation of information	179	227	204	68	678	2.76	0.95	0.34
6	Difficulty in getting syllabus-oriented material	184	236	177	81	678	2.77	0.98	0.35
7	Ineffective information browsing skill	166	192	211	109	678	2.61	1.02	0.39
8	Insufficient knowledge of fair dealing under copyright law of India	193	179	195	111	678	2.67	1.06	0.40
9	Insufficient knowledge to avoid plagiarism	201	210	163	104	678	2.75	1.04	0.38
10	Lack of awareness about reliable subject gateways /portals	172	189	197	120	678	2.61	1.05	0.40

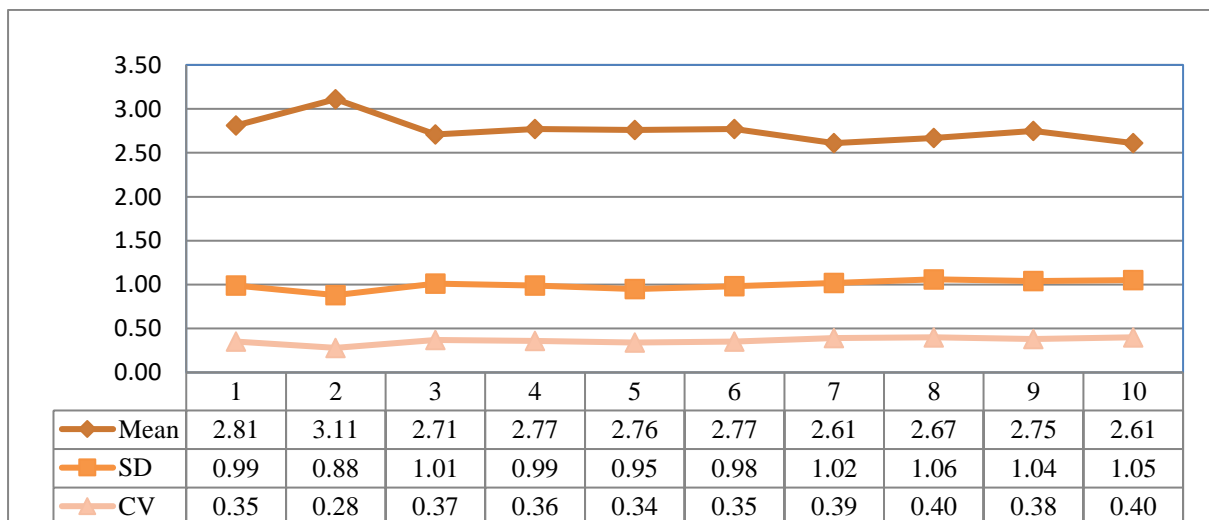


Figure 4: Statistical representation of the challenges in adopting technology for education

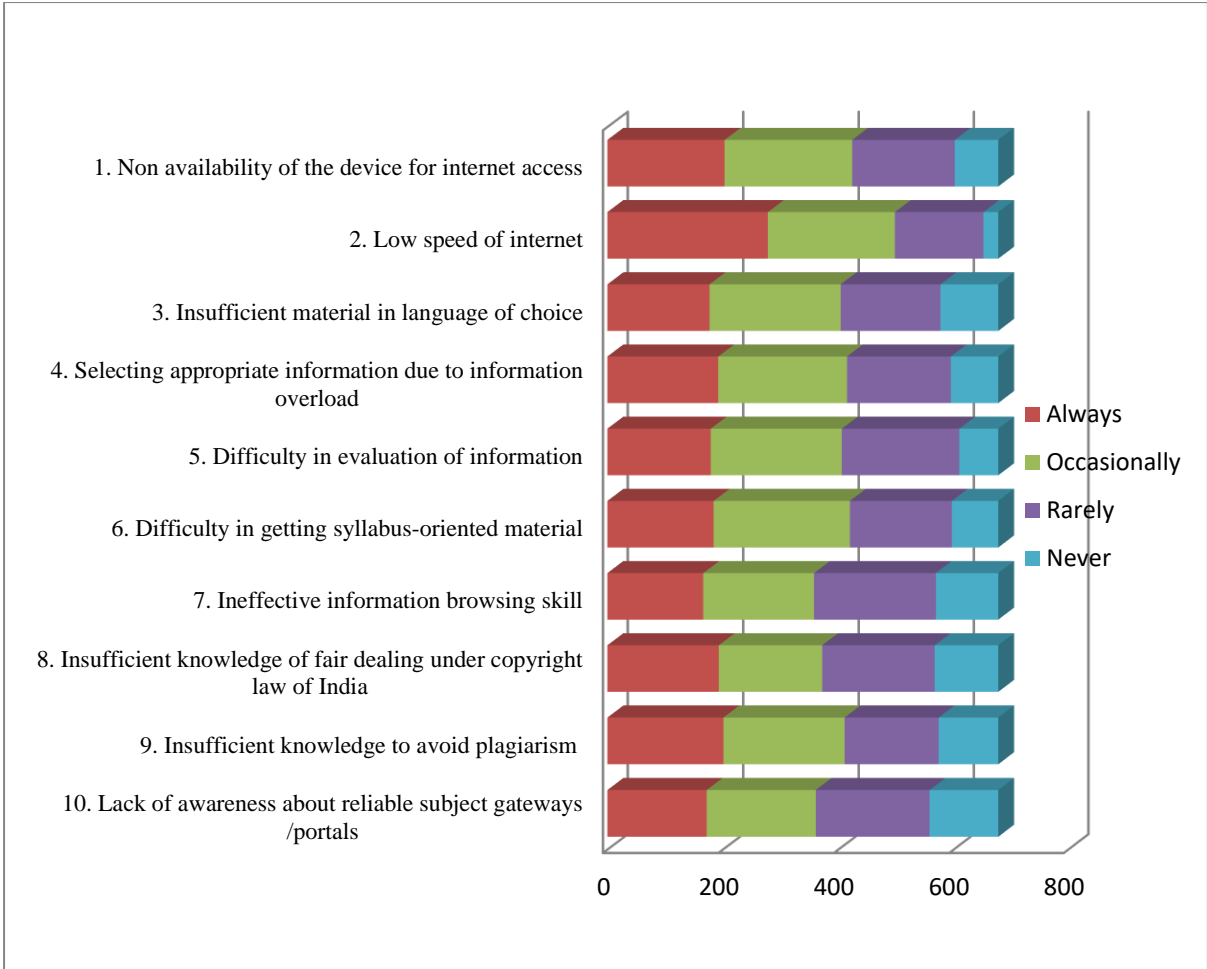


Figure 5: Challenges in adopting technology for education

7. Discussion and Conclusion

The present study was carried out to understand the existing condition of the technological developments, its access and use by students in view of the ongoing online teaching as a consequence of the COVID -19 pandemic. The study sought to obtain empiric information from the students on their digital academic journey and establish subsistence of many challenges that need to be addressed. From the responses a stronger emphasis on technological difficulties has come to the fore. The main barrier to students' access to technology was the financial background as per the reply of the participants. The study found that internet access being too expensive was more commonly the main barrier for children from low-income families and lack of ownership of device deprived the students to access internet at home. Because of lack of high speed internet access and device ownership some students struggled to participate in digital learning. The possible reason for this could be that the transition to online teaching was unplanned and very sudden and the required

technological infrastructures were not fully in place. As it is apparent that the integration of ICT in education will be further accelerated and that blended learning will eventually become an integral component of education, in the event of that, it will be the responsibility of the policy makers to ensure some practicable and cost effective alternatives to assure technology based education is available even to the under privileged children. Further, insufficient digital skill became another obstacle in adapting to remote learning. It is noticeable that despite belonging to the digital age, many students lack the required digital competency to effectively navigate, evaluate, and use the overabundance of information available today. This suggests that the area may be an important theme for future research as it needs a detail investigation in a more elaborate survey to understand how the students continued their study throughout the year. Thus it is paramount that to enhance both the efficacy and accessibility of education there is a need of attention from the governmental level. With more investments it would be possible to ensure high-quality education affordable and accessible to people everywhere including the most remote regions of the country. Digital literacy skills being increasingly vital in the present information age, dedicated efforts at the Institutional level. It will be crucial in improving the required competencies among the students to enable them to achieve not only their curricular objectives but will be invaluable for life and work.

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