

Thumbs Up For Blended Learning In Higher Education In India: Reflections From The Statistical Analysis Of The Results Of A Student Survey

Raj Kumari Bahl^a

^A Department Of Statistics, Ramjas College, University Of Delhi, India

Abstract:

COVID-19 pandemic has altered our lives forever. It has impacted every sphere of life including the most important faculty of mankind that makes us humans i.e. the ability to learn and understand through a proper medium. Indeed this mis-happening has changed the way education has traditionally been imparted worldwide. The digitalization of education has become the need of the hour in order to provide uninterrupted teaching in the wake of catastrophic events such as this pandemic. E-learning is relatively new in India and has never been done on such a mega scale as during this pandemic. In fact this sudden transformation to digitalization and Ed Tech (Education Technology) has posed numerous challenges to both teachers and students throughout the nation. Keeping this in mind, in this paper we address the problems faced by the students in India who are pursuing higher education during these testing times. We also try to unravel the positive and negative impact the pandemic had on the teaching, learning and evaluation methodologies at undergraduate and postgraduate level by taking into account the applaud and criticism of the methodologies adopted for online teaching during this time. For this we present the results of an online students' survey circulated through Google forms among various undergraduate and postgraduate students of different Universities across India. The survey was carried out in the months of January and February 2021 and a mammoth number of 919 responses were obtained. Experience of first wave was taken into account and the onset of second wave was just observed. 34 tests of association were performed to understand in depth the mood of respondents about online learning, teaching and assessment and blended learning in future vis-à-vis their gender and the state to which they belonged. The results indicate statistically significant differences between males and females in regards to all factors except for the levels of satisfaction for steps taken by the institutions to ensure continuity of online learning and modifications in the Open Book Examinations (OBEs). The students who belong to various states also differ markedly in their opinion about the Teaching-Learning process during COVID-19. The survey also reveals that the concept of blended/hybrid learning appeals to a whopping majority (about 63%) of the respondents. This study paves the way for future of online studies in Higher Educational Institutions (HEIs) in India and validates the New Education Policy (NEP) policy of integrating online education into the curriculum.

Keywords: COVID-19, Online Education, Ed Tech, Open Book Exams (OBEs), New Education Policy (NEP)-2020, Blended Learning, Smart Classrooms.

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I. INTRODUCTION

Albert Einstein had once said that “Education is not the learning of facts but the training of the mind to think”. The 2019 COVID-19 pandemic has changed the methodology in which education has been imparted around the globe affecting both students and teachers worldwide. In the case of ‘Higher Education Institutions’ (HEIs), the situation has been worse since they were forced to shut down for a very long period of time due to the fact that the students enrolled in these institutions come from not only the city where this institution is placed but from other cities, states and sometimes countries. The natural alternative was to switch over to online mode in order to maintain continuity, avoid loss of time for the students and abide by the academic calendar. Prior to COVID-19, developing countries such as India were the abodes of traditional methods of imparting education viz. the ‘Chalk and Board’ system. As a result the emergency transition to online education shook the entire teaching-learning fraternity and called in for certain SOS practices to be adopted by both teachers and students. As a result it became very important to judge the effectiveness of the online mode to see whether the students were comfortable with this gigantic leap to Ed Tech. Keeping this in mind, the present paper throws light on the sanctity of the online system by processing the answers to a comprehensive online student survey

circulated among students of different universities across India asking them about online teaching practices, learning perception, 'Open Book Examinations' (OBES) and Blended/ Hybrid learning in future.

Review of Literature

A lot of literature has appeared on the teaching, learning and evaluation methodologies in higher education post the COVID-19 pandemic. For an exhaustive review one can refer to Sousa et al. (2022) and Selvaraj et al. (2021). While the former present an extensive key word search connected to literature on online teaching post COVID, the latter highlight online technologies adopted in various nations worldwide. An excellent reference presenting the summary of future of online education worldwide is David et al. (2022). Further, a detailed review of the literature on this subject also appears in Bilgiç, H. G. (2022), Bilgiç, H.G. (2021) and Gope et al. (2020). The latter throw light on struggles and strengths of the COVID-19 pandemic in Indian university education. Majority of students contacted by them suggest a project-based course curriculum in both mediums viz. physical or virtual. Bozkurt and Sharma (2020a) review the setback in education caused on a global scale due to the COVID-19 pandemic. As a remedy to avoid loss of educational years, many countries have shifted from offline mode to online mode which has indeed given way to a hybrid mode in many institutions. However many educators fear that the quality of education may suffer while imparting education through online mode (Carey, 2020). Ali (2020) pin points that flexible and robust education systems during and after the pandemic is the need of the hour. The author employs meta-analysis methodology to reveal that apart from resources; staff readiness and confidence and student accessibility and motivation form a significant part of 'Information and Communication Technique' (ICT) integrated learning. The same pedagogy is echoed by Bozkurt and Sharma (2020b) who suggest an innovative ideology to convert the pandemic situation into an opportunity. The significance of digital learning using ICT has also been considered by Rapanta et al. (2020). The Chinese government declared a policy of 'Suspending Classes without Stopping Learning' in order to circumvent disruption of teaching. Their policy lacked insight and to overcome its shortcomings, Zhang et al. (2020) have suggested that 'the government needs to empower imparters and recipients with homogeneous home-based teaching/learning equipment'. It needs to organize virtual teacher training and to integrate academic research into the virtual mode of education.

The threat of another COVID-19 wave has not been ruled out by health experts around the world. The re-opening of institutions brings along the danger of viral resurgence (Russell et al., 2020). Student safety and health care should be given the greatest weightage. New Zealand, China, U.S., Japan and indeed the entire world is presently witnessing an upsurge in COVID-19 cases. Probably the times to come would again be a witness to a novel seating matrix, off-and-on classes, innovative canteen and library rules, overhauled hostels and canteens in 'Higher Education Institutions'.

Motivation

Despite numerous research investigations in the past, the viewpoint of the students in context of blended learning to be adopted in the long run in educational institutions in India has not been addressed. In the wake of the pandemic, what adaptations are required in the long run teaching-learning process, the course curriculum and examinations based on the facilities that students have is investigated. To the best of our knowledge this is the only survey to date in which students of University of Delhi (D.U.), one of the largest universities of India, having a massive enrolment, have expressed their views about online learning post Covid-19. In fact 792 D.U. students participated in the survey. Moreover this is the only survey in which questions about blended learning have been discussed. We feel that the results of this investigation will be very helpful in i) painting a fuller and holistic picture about our present standing in the online education system in HEIs, ii) improving and improvising online methodologies of imparting education to students and evaluating them, thus empowering the post-COVID classroom and iii) validating the government policy of integrating online education into the curriculum under NEP-2020.

II. MATERIAL AND METHODS

The aim of the present study is to investigate the weaknesses and strengths of the online system of education. The modus operandi constituted the following steps: i) Designing the questionnaire ii) Collection of Data iii) Data Interpretation and Analysis

Designing the Questionnaire

A cross sectional study has been conducted using a questionnaire comprising 27 items. The data is collected from under graduate and post graduate students studying in different colleges and universities of India. The content of the questionnaire had the following parts: (1) Title of the questionnaire; (2) Name; (3) Gender; (4) Email; (5) Phone; (6) Pin Code; (7) Graduation Level; (8) Semester; (9) College/ University; (10) Multiple choice questions.

A Google Form survey questionnaire was designed to seek answers to the 27 questions which involved open-ended as well as closed-ended queries. Some questions were based on the Likert scale. The survey was based on the principles of voluntary participation, confidentiality and anonymity.

Collection of Data

The survey was circulated among the target groups in different states of the country from 23rd January to 23rd February 2021 through e-mail, Whats app and other messaging techniques. It was the most crucial time of the pandemic in India as the first wave had terminated and the most fatal second wave was beginning to commence. An overwhelming response of 919 students was received.

The participants in this investigation constitute both the genders from the higher educational institutions studying in graduation and post-graduation courses across various Universities of India. Respondents from 20 states participated. The percentage of females (69%) outnumbered the males (31%) by more than double. The majority of the respondents were undergraduate students (85%). Moreover maximum students who participated were from the state of Delhi (38%) followed by U.P. (25%) and Haryana (20%). 86% students were from D.U. followed by 7% from Maharishi Dayanand University (M.D.U.) , 2% from Central University of Haryana (CUH) and 1% from Indian Institute of Technology (IIT), Kanpur. The participants are from a wide spectrum of streams viz. Humanities, Commerce, Sciences, Management and Medicine such that 63% were enrolled in Science stream, 19% in Humanities and 15% in Commerce.

Data Interpretation and Analysis

We analyzed the answers to all questions and also carried out in-depth analysis for certain specific issues.

III. RESULTS AND INTERPRETATION

We investigated the beliefs and judgments of the students enrolled in HEIs of the nation in the following order.

Answers to Specific Questions

Basic Information

The survey was conducted in January-February 2021. 96.8% students were studying in online mode while out of the remaining, 1.6% were in hybrid mode while the rest were going to offline classes. This clearly indicates that online classes acted as a saviour for the students to help them avoid loss of academic years.

Out of the students studying in online mode, 72.9% said that the full strength of the class was able to take the online lectures while 17.7% indicated a negative response. 9.4% were of the view that this question is not applicable to them. This indicates that we need to empower our higher education virtual classrooms to let cent percent class to be accommodated. This involves expanding subscriptions for platforms like Google Meet and Microsoft Teams at the institutional level.

Virtual Class Room and Mode of Teaching

When asked about the choice of digital equipment readily available with students for setting up the virtual classroom and studying in the online mode, 43% of the students said that they were attending their classes on mobile phones while 41.8% were using a laptop and mobile phones together to study. Smart phones have been the most handy tool during this emergency remote teaching. A cylindrical 3d-bar graph (Fig 1) shows the distribution of students using different kind of devices for taking lectures in the online mode.

In regards to the mode of teaching adopted by their teachers in the online mode, students were asked to reply in such a way that they could choose multiple options. 98.5% of the students replied that teachers were sharing notes and discussing them verbally either through inbuilt applications such as white board and meet, or using black board through a webcam and power point presentations. All these modes fall under the purview of what has been referred to as 'Synchronous Teaching' - a term that is very commonly used in the post pandemic era to describe situations where the students and teacher are in the same place, at the same time, through an appropriate online medium for learning to take place. The spirit of this type of teaching pedagogy is in harmony with physical classes and therefore is very popular in the teaching-learning fraternity. In a way it is a kind of 'Pseudo Classroom' that has been created virtually. Synchronous online classes offer a more active and dynamic way of learning in contrast to 'Asynchronous Teaching' where in recorded lectures or notes are shared with students. An excellent reference for synchronous and asynchronous settings of online teaching and learning is Fabriz et al. (2021). It is commendable to note that in this emergency to shift to remote teaching, teachers all around the country have been the flag bearers of this digital revolution. They have taken all difficulties into their stride and worked for the welfare of students.

When asked about their interaction with teachers in the virtual mode in comparison to 'face-to-face' mode, 55.8% respondents felt that interaction was better in latter, while 20% had the feeling that online system

fared in a better way. 21.8% could not decide which mode was better while for the rest the question was irrelevant. Probably for the 20% of the students who preferred online classes were students who were more introvert and shy to ask questions in person. Virtual learning in a way offers them to 'hide' their identity partially making them more comfortable to be vocal. More detailed discussion pertaining to interaction appears in the ensuing section.

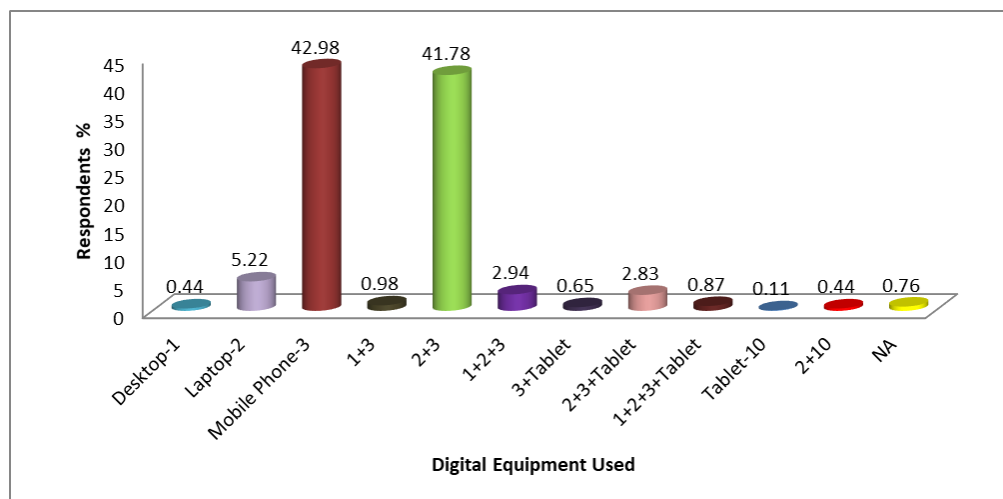


Fig 1: Digital Equipment used by students for undertaking Online Classes

Teaching–Learning–Assessment Experience

Under the teaching-learning system, the students were asked to mark their view points on a 6 point scale (Likert scale) on various issues pertaining to online teaching.

Table 1: Table showing Opinion of Participants about the Online Teaching–Learning–Assessment Experience during the COVID-19 Pandemic

In regards to	Excellent	Very good	Good	Neutral	Bad	Very bad
Ease of connection to the Internet	10.6%	22.9%	21.9%	26.6%	12.3%	5.9%
Access to digital devices (phone/ tablet/ laptop/ computer)	24.7%	23.9%	26.9%	16.5%	6.0%	2.0%
Accessibility and utility/efficiency of the virtual podiums	15.3%	23.2%	24.7%	23.4%	9.4%	4.0%
Interaction and exchange with teachers (teaching courses, organizing laboratories/ seminars/ other practical applications)	12.4%	17.0%	20.8%	25.4%	14.9%	9.6%
Interaction and exchange with teachers (furnishing personalized or group feedback, guidance/ tutoring)	11.0%	20.1%	20.8%	27.3%	12.4%	8.4%
Quality of virtual learning materials (e.g. courses, multimedia content: audio, audio-video, etc.)	10.8%	20.1%	22.4%	27.3%	13.3%	6.1%
Group Discussion with Classmates/Seniors etc.	9.5%	17.7%	18.7%	22.4%	17.7%	13.9%
Motivation to learn	11.0%	16.1%	15.9%	22.7%	18.5%	15.8%
Assessment/Examination	15.1%	19.8%	18.4%	27.6%	11.4%	7.6%

We analyze the results in the above table row wise and then take up discussion as a whole in Section 4. For the 18.2% students who found it difficult to connect to internet were probably students in the more remote areas where the digital revolution is yet to take place in full bloom. Other reasons could be limited data packs, electricity cuts and outdated devices which fail to connect to the 4G networks. In regards to access to digital equipment only 8% seemed to struggle hard. India is well known for its mobile revolution in the world. About 64% of the respondents felt that the online platforms fared well in meeting their needs of getting home educated. Many HEIs had bought subscriptions of online platforms such as Google Meet, Google classroom, Zoom and Microsoft teams in order to accommodate full strength classes.

In regards to other barometers of the performance of the online scheme of learning, one can see a staggered response of the students. As far as the interaction and communication with teachers was concerned in sense of teaching courses, conducting laboratories/ seminars/ other practical applications, about 25 in 100 students felt that they suffered a lot. About the same percentage took a neutral disposition because probably they felt indifferent or uncared for. This means only 50% of the respondents had an “excellent” or “very good” or “good” viewpoint regarding this question. For online education to become an integral part of the curriculum of HEIs in the future, this percentage needs to be improved. This can be done by organizing group discussions

in smaller batches which will give students personal attention, thus throwing limelight onto them so that they do not get the feeling of being neglected. We take up the point of dearth of practical classes in the online system in a subsequent subsection 3.1.5. The question about providing personalized or group feedback, guidance/ tutoring found 20.8% of the students extremely uncomfortable. This is an area where offline education has an edge over its competing counterpart-the online system.

As far as the quality of online learning content, a little more than half of the respondents were extremely satisfied while 27.3% remained neutral. Further, the shadiest area in the remote teaching mode is lack of peer to peer interaction. When enquired about this field, 31.6% of the respondents felt that they had lost touch with their class fellows and seniors. About 27.3% remained neutral probably because they felt neglected and therefore lacked the motivation to express their views. For online education to appeal to majority of users it is extremely important to revamp and refurbish this aspect by engaging students in discussion forums, online quizzes etc., thus promoting peer interaction. This will act as a fertilizer to nourish their interest in virtual learning.

If one looks at the motivation of students to learn in the virtual classroom, it appears almost 35% of the students lacked motivation while about 23% were neutral to this question. Internet, although is a powerful medium of knowledge transfer also acts as a big distraction for young minds. Patiently listening and working with what is in front of them as an online lesson seems more and more onerous in a ‘Virtual Classroom’ as there is always that strong urge to open another site or read something else while the lecture is going on. Quite commonly students just log into the classes and then wander here and there in their homes or on the internet itself. Lack of personal student-teacher relationship and inability to voice their thoughts and being heard are other factors that lead to a plunge in the motivation to study.

A very interesting observation in the table above is that in regards to online evaluation only 19% of the students felt ‘bad’ or ‘very bad’. This is attributed to ‘Open Book Examinations’ (OBEs) in the online medium of teaching in HEIs which offer the students a very comfortable methodology of assessment in comparison to the conventional physical offline examinations. We elaborate this point further in Section 3.1.6.

The students were also asked about their level of satisfaction in regards to the Steps taken by the University/ college/ institution during the COVID-19 pandemic to ensure the continuity of the educational process with respect to three essential components viz. teaching, learning and assessment on a 6 point scale (Likert scale). The following self-explanatory cylindrical 3d-bar graphs show their feedback.

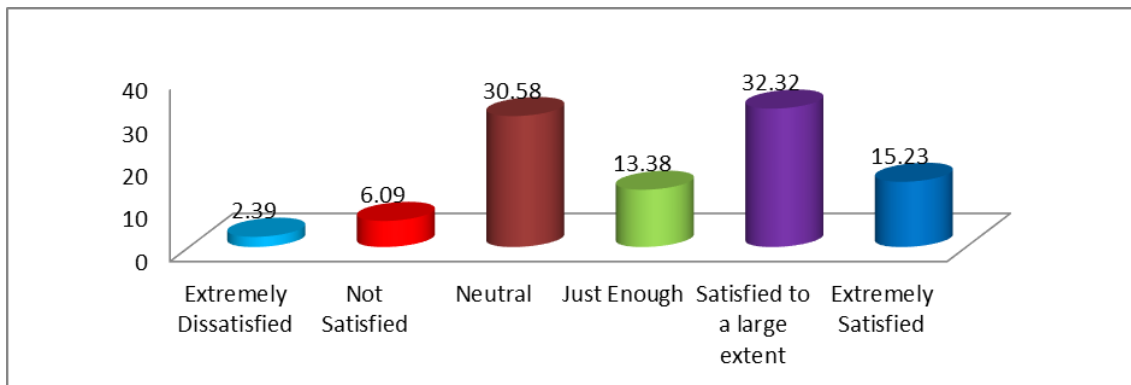


Fig 2: Level of Satisfaction of students for steps taken by the University during COVID-19 for Teaching

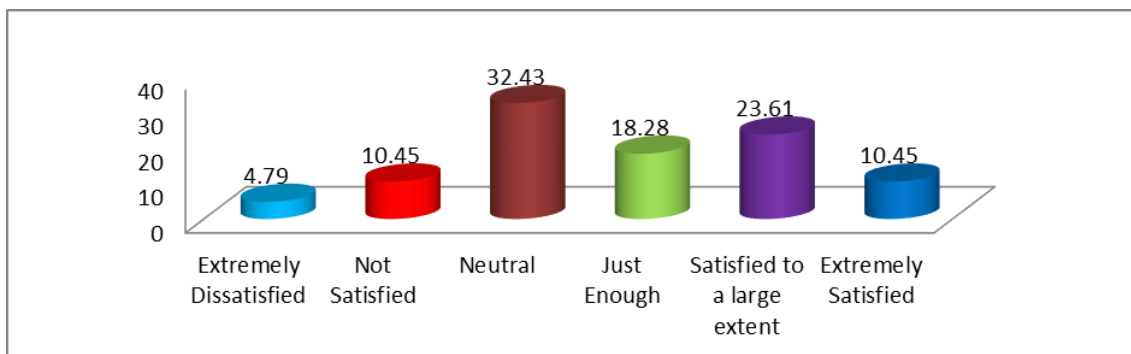


Fig 3: Level of Satisfaction of students for steps taken by the University during COVID-19 for Learning

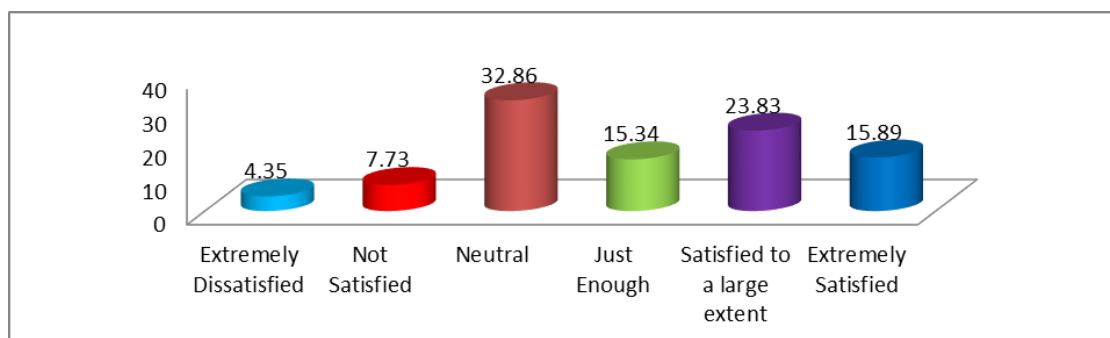


Fig 4: Level of Satisfaction of students for steps taken by the University during COVID-19 for Assessment

As can be seen from all the three graphs, the percentage of extremely dissatisfied and not satisfied proportion is extremely low, which shows how well the metamorphosis into e-learning has occurred.

We also questioned students about which other online tools apart from classes were appealing to them for the virtual learning process through an open-ended format. 31.6% of the students utilized websites and You Tube while 28% took advantage of the former along with webinars, digital Platforms such as SWAYAM, nptel.ac.in, online free books and online libraries like NLIST, online data repositories like data.gov.in, data.worldbank.org, NSE, BSE, etc. for practical classes, virtual labs, Massive Open Online Courses (MOOCs), Wiki Pages, research networks such as VIDWAN and qualitative electronic resources such as e-ShodhSindhu. A very integral part of higher education is the physical library which is not only the reservoir of knowledge but also a niche which promotes healthy learning through reading and an amicable environment. The only compensation for the non-availability of the physical library in online system could be the development of efficient digital libraries which instigate confidence into the students and make them feel engrossed in e-books and e-resources. A very recent reference in this regard is Zamadar (2022). Other useful media employed by them for online learning were teaching marketplaces such as Udemy and digital platforms such as Webex.

Perceptions about Blended Learning

As indicated in Section 1.2, one out of the three-fold objectives of this student survey was to get a feel of their mood about blended learning, which is a key objective in the New Education Policy (NEP)-2020. The students were asked on a 6-point Likert scale about their feeling about the proposal to amalgamate traditional (face-to-face) education with online education i.e. teaching in a blended/hybrid mode and their reactions are shown below.

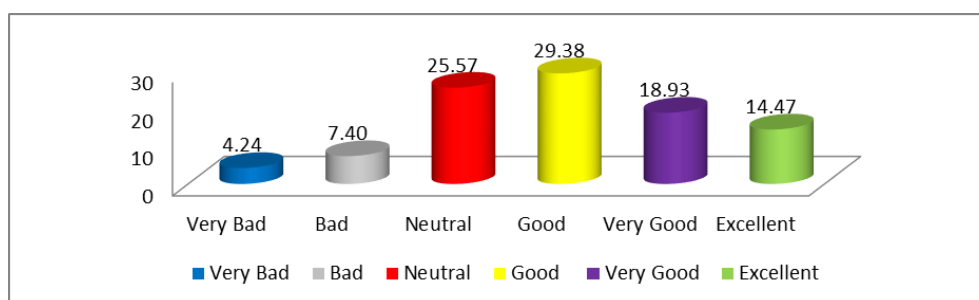


Fig 5: Opinion of students in regards to Teaching in a Blended Mode

Clearly, 62.78% of the target audience considers blended/hybrid learning excellent, very good or good. This is a very significant percentage. 25.57% chose to stay neutral. Only 11.64% oppose this innovative mode of teaching. This is indeed great news as any uncalled in events in future which may lead to disruption in the continuity of education in future may be evaded by considering a disaster management plan involving blended/hybrid learning. It is extremely important to understand the difference between blended and hybrid models of learning. In the Hybrid case, the participants can make a choice to attend the classes in person partially or completely or follow them on screen from any location in the same format. Indeed, the hybrid model is a mixture of face to face and online instruction, encompassing conventional styles of teaching and learning with online teaching practices. Hybrid learning strives for a balance that guarantees the best experience for students' requirements through any possible learning technique. Blended learning, on the other hand is in fact a split model between virtual and physical media; i.e. it is and-and. A blended course is both fully online and fully offline. In the blended model a face-to-face interaction is an integral component of education that cannot

be provided online or via other digital means. Usually in blended learning instructions are furnished online to complement and supplement the physical classes. Unlike hybrid learning, blended learning does not forego the advantages of real interactions. For more details the reader is referred to López (2021).

When the students were asked to voice their opinion about the advantages of blended learning, about 53% felt that it would offer greater flexibility and self-paced learning. 11.5% of the repliers had the belief that hybrid learning would improve mental health and well-being. 9% of the respondents thought that blended learning would lead to better monitoring of the learning progress of students and update them with information regarding their self-improvement. About 7% felt that it would unravel opportunities to improve support for students from underprivileged groups. This could be done by providing them with suitable devices to access online classes if they find it difficult to attend full schedule offline classes. 5% of the interviewees were of the view that it would provide them with more diversified forms of assessment/examination.

The question about disadvantages of blended learning saw the students rank the option of difficulty of students to adapt to a blending learning system with the highest percentage of 54% out of which a whopping fraction of approximately 31% belonged to the opinion that students without availability of appropriate digital technologies are excluded from the teaching-learning process; clearly hinting that improved access to appropriate e-learning tools is a must for the success of the blended learning system. About 32% of the interviewees felt that teachers would face a difficult time adapting to a hybrid teaching system. This is because the students probably thought that switching continuously between online and offline systems of imparting education will become a sort of headache for the teachers as they would need to plan their lessons accordingly. This would also mean revising the teaching plan in an efficient manner to do justice to the curriculum and complete the syllabus in time. About 11% of the students felt that the blended system would pose difficulties/challenges in ensuring the information security. Finally, 2% thought that the system would lack seriousness on behalf of the students and also they would miss vibes of institutions while studying in the online mode. 8 students expressed complete confidence in blended system of learning by stating that it had no disadvantage. Interestingly one student also said that that the blended system would reduce “favouring some students by teachers based on appearance and other judgments”.

Looking at this entire scenario from a bird's eye view, it is quite evident that the students are not at all apprehensive of the blended learning but they are wary of the digital divide which can only be bridged by ensuring that difficulties in accessing the online system get removed. This calls upon the government to take appropriate steps in order to justify that NEP-2020 meets its goals.

Data Analysis

The data gathered from the students from various institutions are analyzed using a variety of statistical tools.

Validity

First of all, on inspecting the data using Excel it was clear that the three states that dominated the survey were Delhi, U.P. and Haryana such that their participation accumulated to 83% of the total respondents. We therefore merged the data from the remaining states under the category ‘Others’ to obtain more accurate results while analyzing. It was found that 760 respondents belonged to the three aforementioned states.

Testing

We conducted 34 dependency checks using Chi-square (χ^2) tests of association utilizing SPSS. Test of hypotheses used in the analysis are presented below and the results are portrayed in the subsequent tables and figures.

The first point of analysis was all elements of table 1. We performed Chi-square (χ^2) tests of independence of attributes between the opinion about the each aspects of online ‘Teaching-Learning-Assessment’ experience listed in table 1 and gender/state of respondents. The corresponding hypotheses are:

Null Hypothesis: H_0 : There is no association between the opinion about “...” and the gender of respondents.

Vs.

Alternative Hypothesis: H_1 : There is an association between the opinion about “...” and the gender of respondents.

where ‘...’ refers to the respective components of online ‘Teaching-Learning-Assessment’ experience mentioned in column 1 of table 1.

Similarly we set up the following hypothesis for states:

Null Hypothesis: H_0 : There is no association between the opinion about “...” and the state to which respondents belong.

Alternative Hypothesis: H_1 : There is an association between the opinion about “...” and the state to which respondents belong.
We summarize the results below in Table 2.

Table 2: Table showing p-values for Chi Square test for Independence of attributes for Opinion about the Online Teaching–Learning–Assessment Experience during the COVID-19 Pandemic and Gender and State respectively

In regards to	Gender			State		
	p-value	Decision	Interpretation	p-value	Decision	Interpretation
Ease of connection to the Internet	0.018	There is an association in the opinion and gender at 5%. However we may regard absence of association at 1%.	Opinion about Ease of Connection to Internet is gender sensitive at 5%. The gender sensitivity is absent at 1%.	0.000	There is a strong association in the opinion and state at any level of significance (L.O.S.).	Opinion about Ease of Connection to Internet varies with the states at any L.O.S.
Access to digital devices (phone/ tablet/ laptop/ computer)	0.033	There is an association in the opinion and gender at 5%. However we may regard absence of association at 1%, 2% and 3%.	Opinion about Access to digital devices is gender sensitive at 5%. The gender sensitivity is absent at 1%, 2% and 3%.	0.012	There is an association in the opinion and state at 5%. However we may regard absence of association at 1%.	Opinion about Access to digital devices varies with state at 5%. The sensitivity to state is absent at 1%.
Accessibility and utility/efficiency of the virtual podiums	0.005	There is an association in the opinion and gender at any L.O.S.	Opinion about Accessibility and utility/efficiency of the virtual podiums is gender sensitive at any L.O.S.	0.000	There is a strong association in the opinion and state at any L.O.S.	Opinion about Accessibility and utility/efficiency of the virtual podiums varies with the states at any L.O.S.
Interaction and exchange with teachers (teaching courses, organizing laboratories/ seminars/ other practical applications)	0.003	There is an association in the opinion and gender at any L.O.S.	Opinion about Interaction and exchange with teachers is gender sensitive at any L.O.S.	0.007	There is an association in the opinion and state at any L.O.S.	Opinion about Interaction and exchange with teachers varies with the states at any L.O.S.
Interaction and exchange with teachers (furnishing personalized or group feedback, guidance/ tutoring)	0.001	There is an association in the opinion and gender at any L.O.S.	Opinion about Interaction and exchange with teachers in regards to personalized feedback is gender sensitive at any L.O.S.	0.091	We may conclude an absence of association in the opinion and state at any L.O.S.	Opinion about Interaction and exchange with teachers in regards to personalized feedback does not vary with state at any L.O.S.
Quality of virtual learning materials (e.g. courses, multimedia content: audio, audio-video, etc.)	0.001	There is an association in the opinion and gender at any L.O.S.	Opinion about Quality of online learning content is gender sensitive at any L.O.S.	0.092	We may conclude an absence of association in the opinion and state at any L.O.S.	Opinion about Quality of online learning does not vary with state at any L.O.S.
Group Discussion with Classmates/Seniors etc.	0.000	There is a strong association in the opinion and gender at any L.O.S.	Opinion about Group Discussion with Classmates/Seniors etc. is highly gender sensitive at any L.O.S.	0.001	There is an association in the opinion and state at any L.O.S.	Opinion about Group Discussion with Classmates/Seniors etc. varies with states at any L.O.S.
Motivation to learn	0.000	There is a strong association in the opinion and gender at any L.O.S.	Opinion about Motivation to learn is highly gender sensitive at any L.O.S.	0.011	There is an association in the opinion and state at 5%. However we may regard absence of association at 1%.	Opinion about Motivation to learn varies with state at 5%. The sensitivity to state is absent at 1%.
Assessment/Examination	0.000	There is a strong association in the opinion and gender at any L.O.S.	Opinion about Assessment/Examination is highly gender sensitive at any L.O.S.	0.357	We may conclude an absence of association in the opinion and state at any L.O.S.	Opinion about Assessment/Examination does not vary with state at any L.O.S.

One can see a strong association in the opinion about ‘Ease of Connection to the Internet’ and states. This can be due to geographical terrain of some states where internet connectivity is poor due to shortage of providers or it could be due to seasonal and political disruptions in specific regions. Examples of former are

cyclones in Orissa in 2021 while illustrations of latter include ‘The Kisan Aandolan’ i.e. the farmers’ protest which led to complete cut off of internet in Haryana for some days. Also, it is evident from the above table that the opinion about Availability and utility/efficiency of the online platforms varies with the states at any L.O.S. This is again connected to the previous point as smooth streaming of classes through online podiums such as Google Meet, Microsoft Teams etc. is highly dependent on a stable internet connection. The above table shows association in opinion about all listed arguments and gender, may be weak in some cases and strong in others. This could be attributed to two plausible causes: one that girls are generally more dedicated than boys and therefore are more serious in their studies in the virtual mode and two that there has always been a gender bias prevalent in India which generally favours boys by their families above females thereby providing the former with better facilities and comfort.

Next we investigate the association between levels of satisfaction for steps taken by the institutions to ensure continuity of online ‘Teaching-Learning-Assessment’ and gender/state. The respective hypotheses are:

Null Hypothesis: H_0 : There is no association between the level of satisfaction about “...” and the gender/state of respondents.

Alternative Hypothesis: H_1 : There is an association between the level of satisfaction about “...” and the gender of respondents.

Here ‘...’ refers to teaching/learning/assessment. Table 3 portrays the results.

Table 3: Table showing p-values for Chi Square test for Independence of attributes for Level of Satisfaction for steps taken by the University during COVID-19 in regards to the Online Teaching–Learning–Assessment during the COVID-19 Pandemic and Gender and State respectively

In regards to	Gender			State		
	P-value	Decision	Interpretation	P-value	Decision	Decision
Teaching	0.022	There is an association in the level of satisfaction and gender at 5%. However we may regard absence of association at 1% and 2%.	Level of satisfaction in regards to online teaching is gender sensitive at 5%. The gender sensitivity is absent at 1% and 2%.	0.245	There is no association in the level of satisfaction and state at any L.O.S.	Level of satisfaction in regards to online teaching does not vary with state at any L.O.S.
Learning	0.126	There is no association in the level of satisfaction and gender at any L.O.S.	Level of satisfaction in regards to online learning is not gender sensitive at any L.O.S.	0.690	There is no association in the level of satisfaction and state at any L.O.S.	Level of satisfaction in regards to online learning does not vary with state at any L.O.S.
Assessment	0.002	There is an association in the level of satisfaction and gender at any L.O.S.	Level of satisfaction in regards to online assessment is gender sensitive at any L.O.S.	0.108	There is no association in the level of satisfaction and state at any L.O.S.	Level of satisfaction in regards to online assessment does not vary with state at any L.O.S.

No association can be found in the ‘Teaching-Learning-Assessment’ and state at any L.O.S. This is attributed to the fact that the institution remains the same even if the students who are attending classes are placed in different states. So there is uniformity in regards to teaching and assessment at the institutional level. Finally we throw light on some important aspects through their association with gender/state by setting similar hypotheses as above. Table 4 shows the results.

Table 4: Table showing p-values for Chi Square test for Independence of attributes for Opinion on some important aspects and Gender and State respectively

In regards to	Gender			State		
	P-value	Decision	Interpretation	P-value	Decision	Decision
Blended/ Hybrid Teaching in Future	0.000	There is a strong association in the opinion and gender at any L.O.S.	Opinion about employing Hybrid Teaching in future is highly gender sensitive at any L.O.S.	0.172	We may conclude an absence of association in the opinion and state at any L.O.S.	Opinion about employing Hybrid Teaching in future does not vary with state at any L.O.S.
Choice of Teaching Mode in Future	0.035	There is an association in the choice of teaching	Choice of teaching mode in the future is gender sensitive at 5%	0.000	There is a strong association in the choice of teaching	Choice of teaching mode in the future varies with the state at

		mode in the future and gender at 5 % L.O.S. However we may regard absence of association at 1%, 2% and 3%.	L.O.S. The gender sensitivity is absent at 1%, 2% and 3%.		mode in the future and state at any L.O.S.	any L.O.S.
Conducting Practical Examinations without any actual Practical Classes	0.010	There is an association in the opinion about Conducting Practical Examinations and gender at L.O.S. 1-5%	Opinion about conducting Practical Examinations without any actual Practical Classes is gender sensitive at L.O.S. 1-5%	0.509	There is no association in the opinion about Conducting Practical Examinations and state at any L.O.S.	Opinion about conducting Practical Examinations without any actual Practical Classes does not vary with state at any L.O.S.
OBEs being the Correct Tool to Judge Performance	0.001	There is an association in the opinion about OBEs being the Correct Tool to Judge Performance and gender at any L.O.S.	Opinion about OBEs being the Correct Tool to Judge Performance is gender sensitive at any L.O.S.	0.179	There is no association in the opinion about OBEs being the Correct Tool to Judge Performance and state at any L.O.S.	Opinion about OBEs being the Correct Tool to Judge Performance does not vary with state at any L.O.S.
Modification in the OBEs	0.113	There is no association in the opinion about Modification in the OBEs and gender at any L.O.S.	Opinion about Modification in the OBEs is not gender sensitive at any L.O.S.	0.247	There is no association in the opinion about Modification in the OBEs and state at any L.O.S.	Opinion about Modification in the OBEs does not vary with state at any L.O.S.

Finally we present below clustered bar graphs for the distribution of respondents gender wise and state wise respectively for various testing procedures accomplished/conducted above.

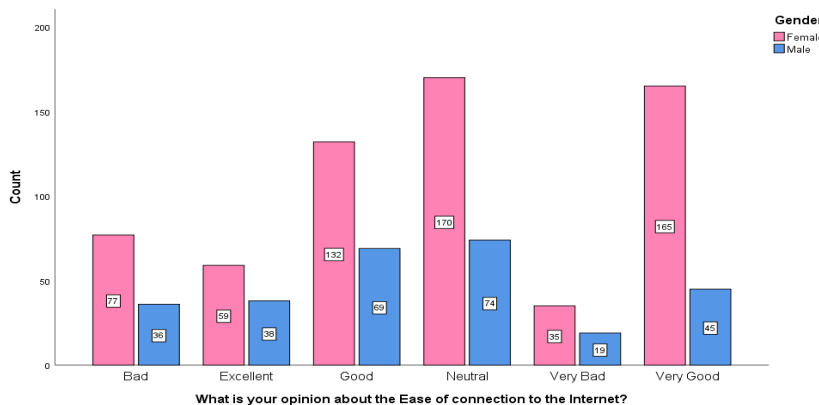


Fig 6: Gender wise Opinion of Respondents about Ease of Connection to Internet

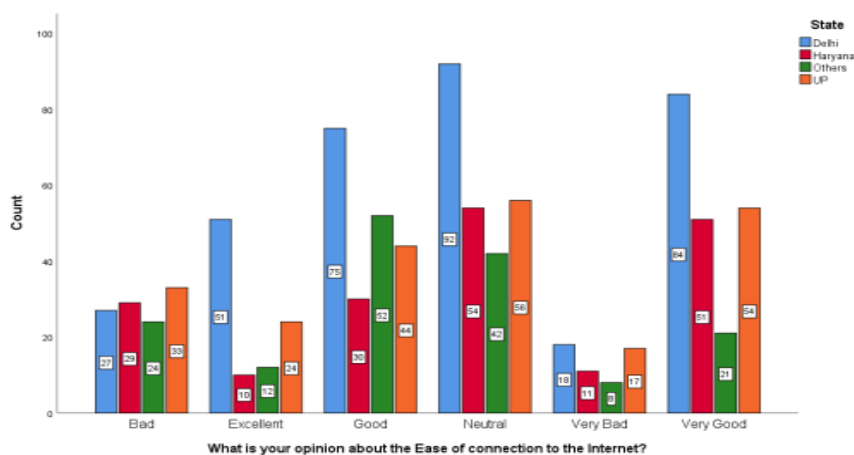
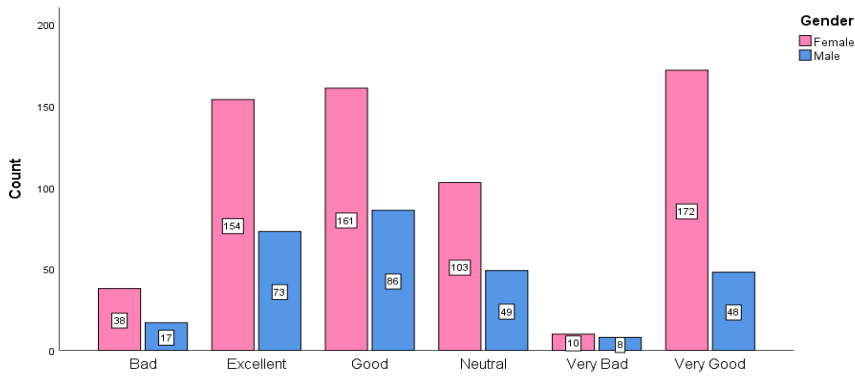
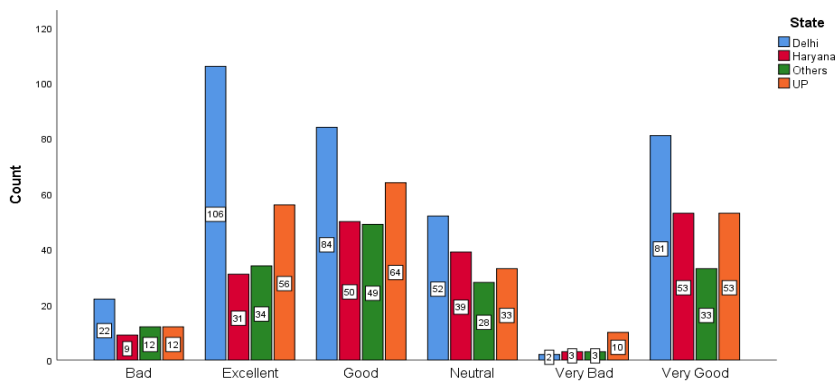


Fig 7: State wise Opinion of Respondents about Ease of Connection to Internet



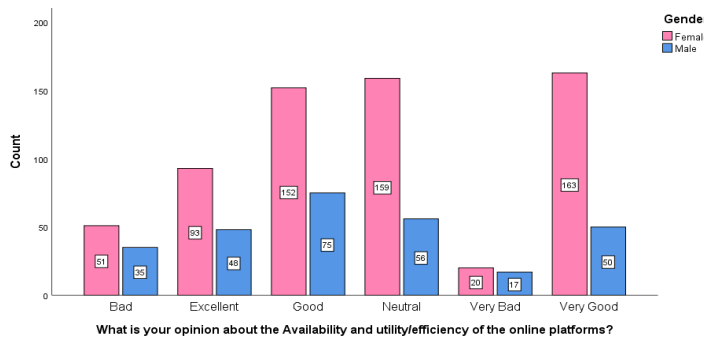
What is your opinion about Availability of digital equipment (phone/ tablet/ laptop/computer)?

Fig 8: Gender wise Opinion of Respondents about Access to Digital Devices



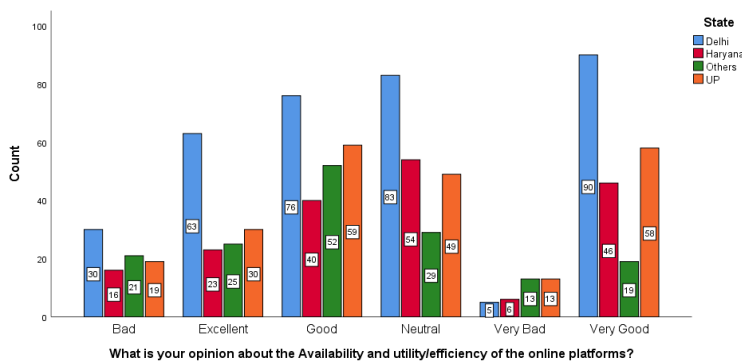
What is your opinion about the Availability of digital equipment (phone/ tablet/ laptop/computer)?

Fig 9: State wise Opinion of Respondents about Access to Digital Devices



What is your opinion about the Availability and utility/efficiency of the online platforms?

Fig 10: Gender wise Opinion of Respondents about Accessibility and Utility/Efficiency of Virtual Podiums



What is your opinion about the Availability and utility/efficiency of the online platforms?

Fig 11: State wise Opinion of Respondents about Accessibility and Utility/Efficiency of Virtual Podiums

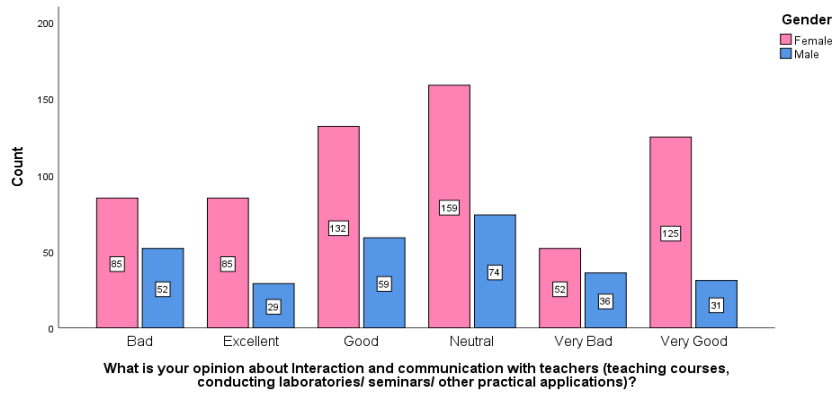


Fig 12: Gender wise Opinion of Respondents about Interaction and Exchange with Teachers

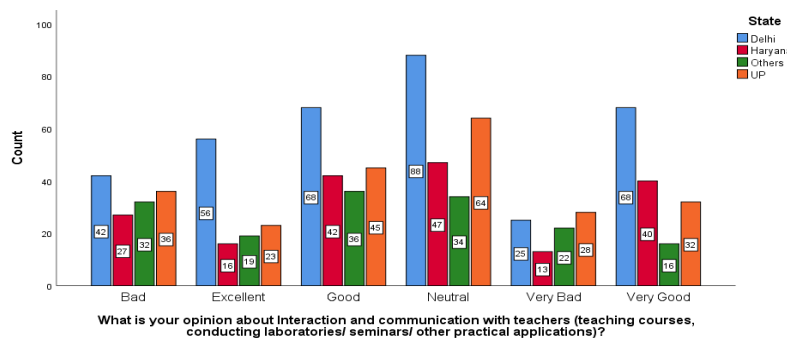


Fig 13: State wise Opinion of Respondents about Interaction and Exchange with Teachers

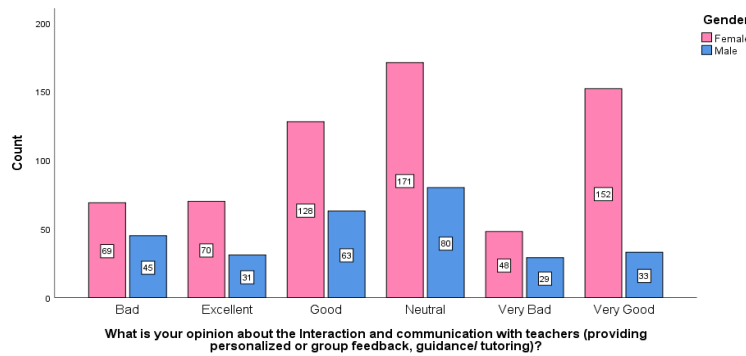


Fig 14: Gender wise Opinion of Respondents about Interaction and Exchange with Teachers in regards to Guidance etc.

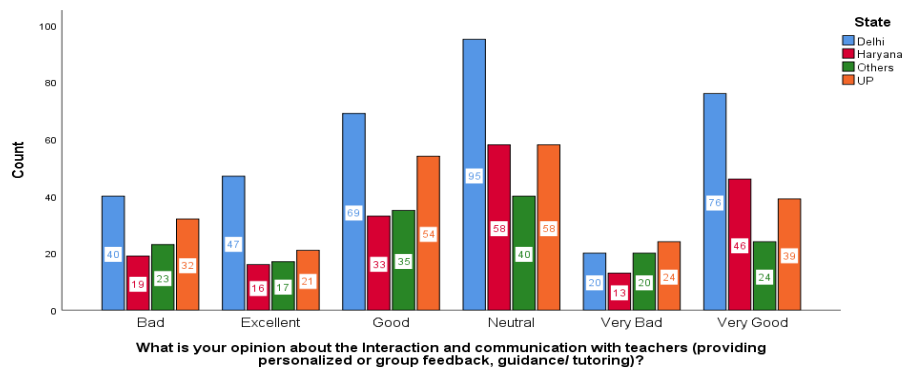


Fig 15: State wise Opinion of Respondents about Interaction and Exchange with Teachers in regards to Guidance etc.

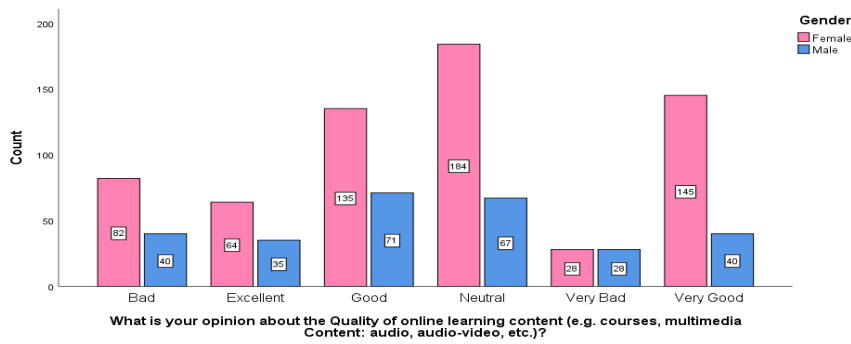


Fig 16: Gender wise Opinion of Respondents about Quality of Virtual Learning Materials

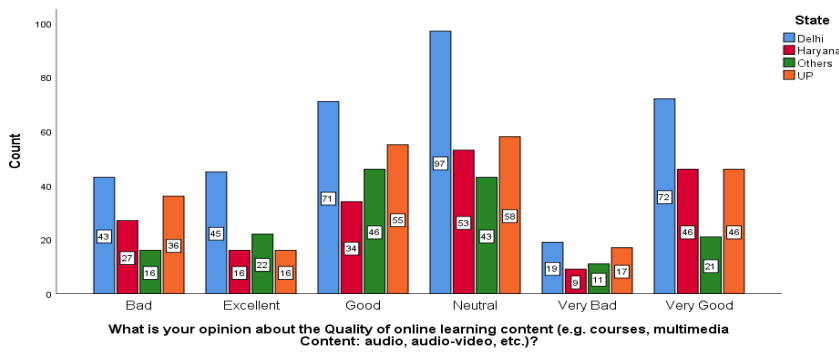


Fig 17: State wise Opinion of Respondents about Quality of Virtual Learning Materials

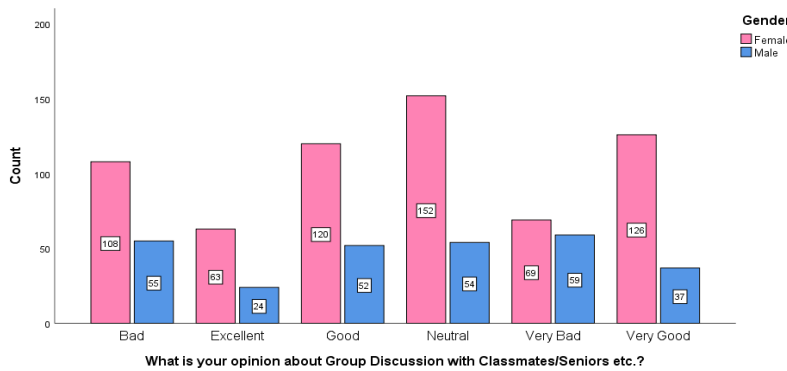


Fig 18: Gender wise Opinion of Respondents about Group Discussion with Classmates/Seniors etc.

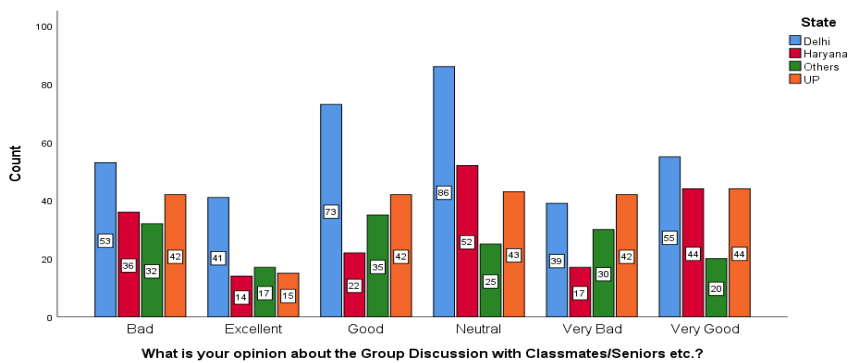


Fig 19: State wise Opinion of Respondents about Group Discussion with Classmates/Seniors etc.

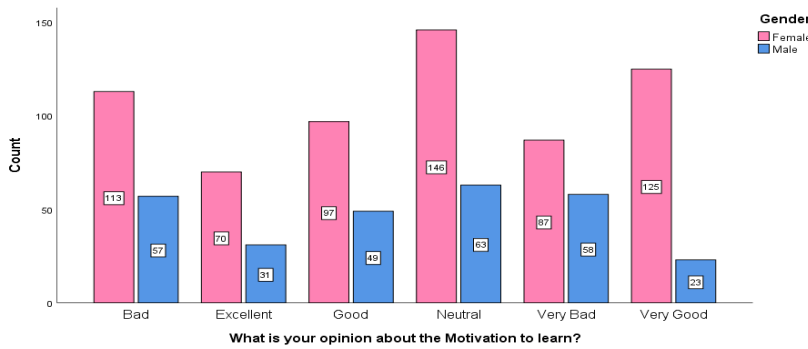


Fig 20: Gender wise Opinion of Respondents about the Motivation to learn

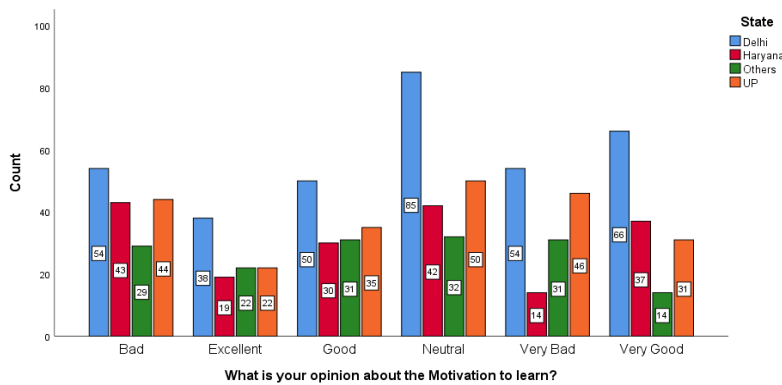


Fig 21: State wise Opinion of Respondents about the Motivation to learn

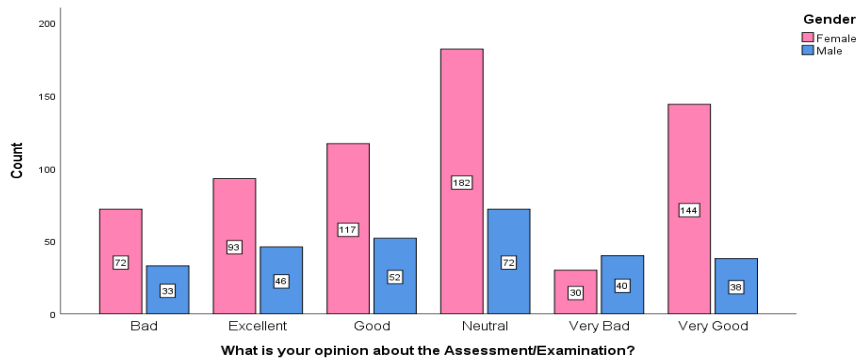


Fig 22: Gender wise opinion of Respondents about Assessment/Examination

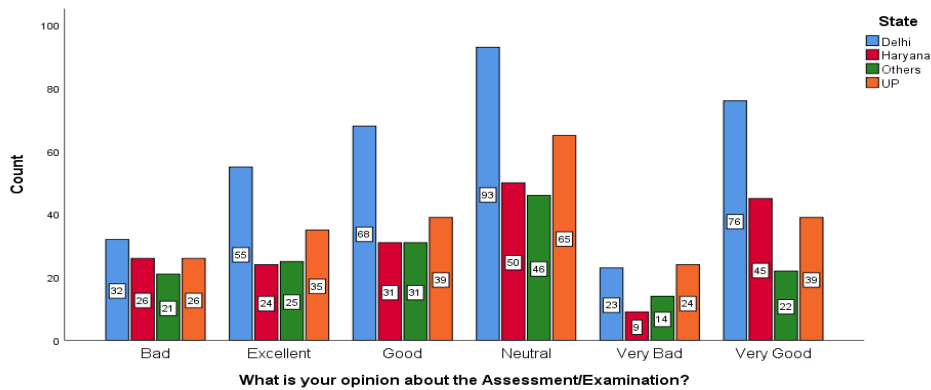


Fig 23: State wise opinion of students in regards to Assessment/ Examination

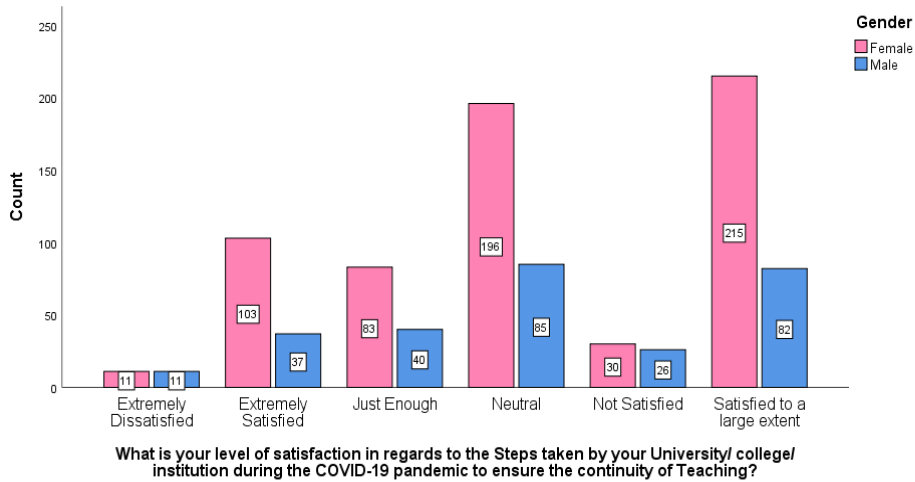


Fig 24: Gender wise Level of Satisfaction in regards to the Continuity of Teaching

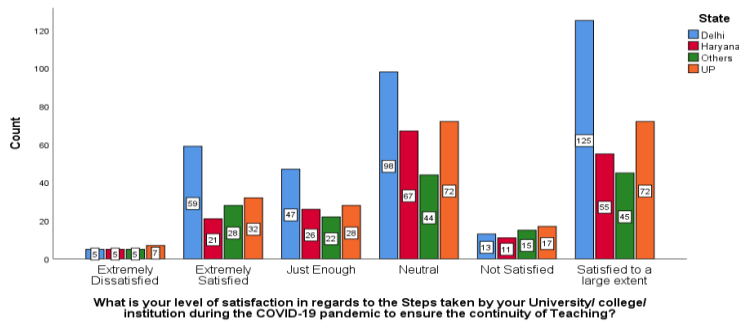


Fig 25: State wise Level of Satisfaction in regards to the Continuity of Teaching

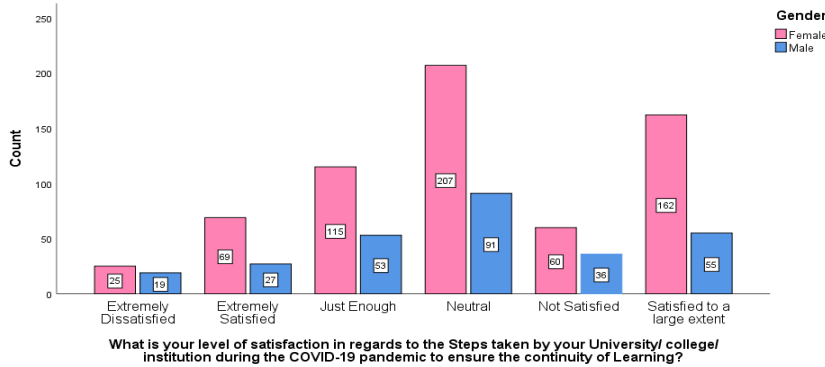


Fig 26: Gender wise Level of Satisfaction in regards to the Continuity of Learning

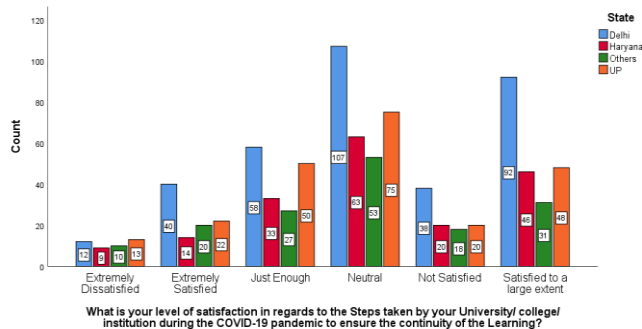


Fig 27: State wise Level of Satisfaction in regards to the Continuity of Learning

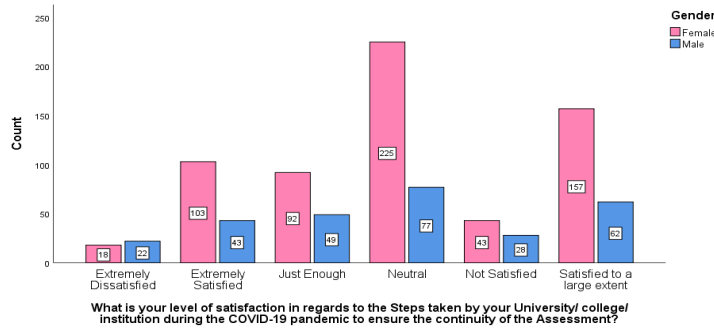


Fig 28: Gender wise level of satisfaction of students in regards to Steps taken by university for the continuity of Teaching-Learning-Assessment

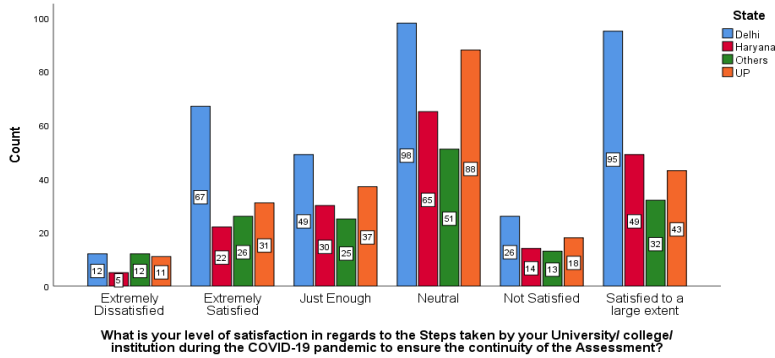


Fig 29: State wise level of satisfaction of students in regards to Steps taken by university for the continuity of Teaching-Learning-Assessment

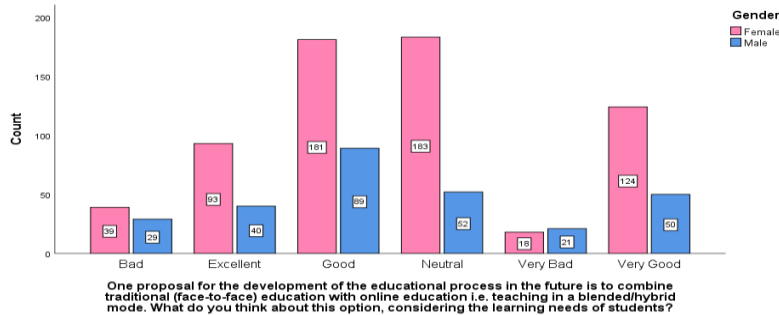


Fig 30: Gender wise Opinion of students in regards to Blended/Hybrid Teaching in Future

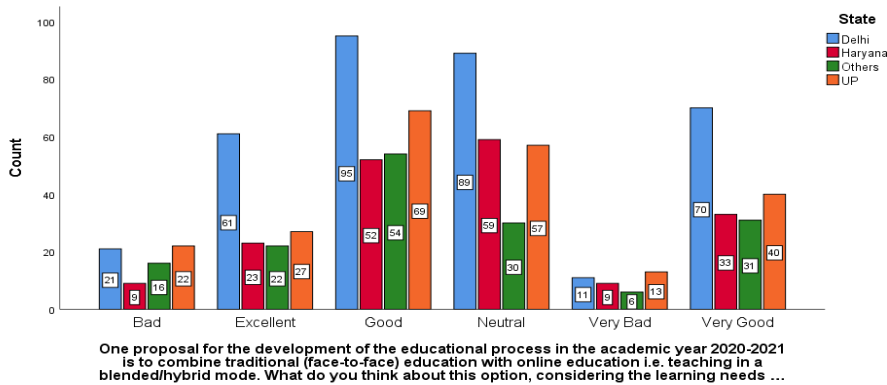


Fig 31: State wise Opinion of students in regards to Blended/Hybrid Teaching in Future

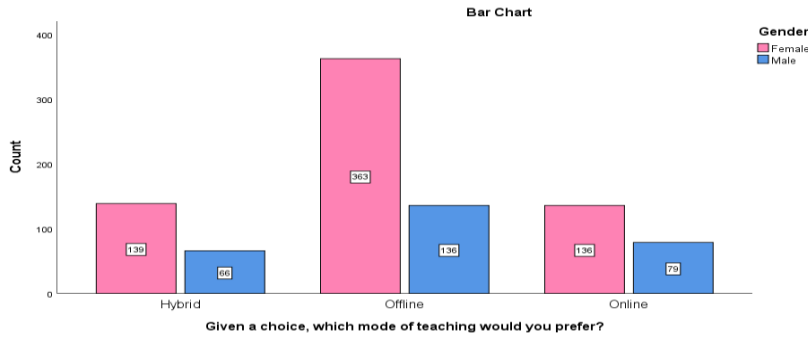


Fig 32: Gender wise Opinion of students in regards to preference about Mode of Teaching in Future

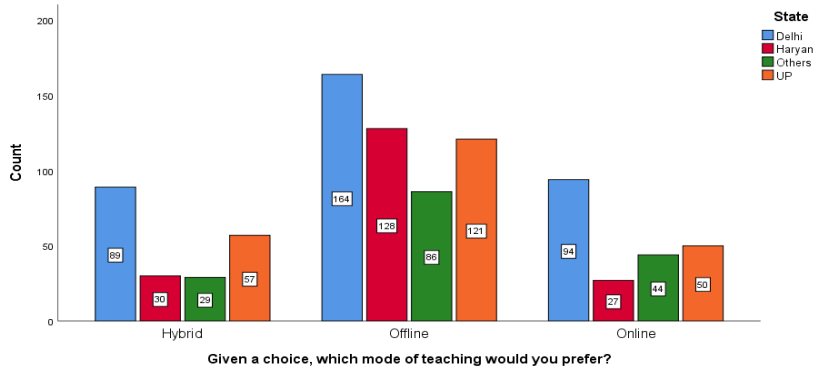


Fig 33: State wise Opinion of students in regards to preference about Mode of Teaching in Future

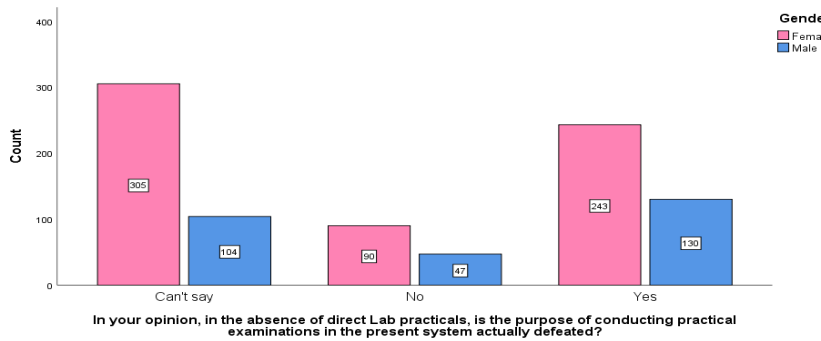


Fig 34: Gender wise Opinion of students in regards to Conducting Practical Examinations without any actual Practical Classes

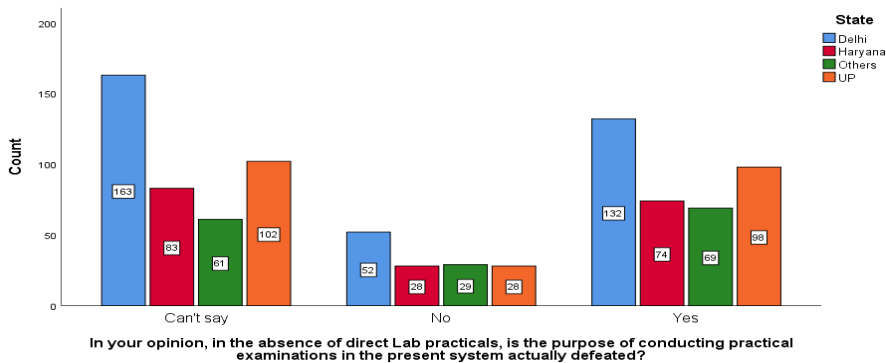


Fig 35: State wise Opinion of students in regards to Conducting Practical Examinations without any actual Practical Classes

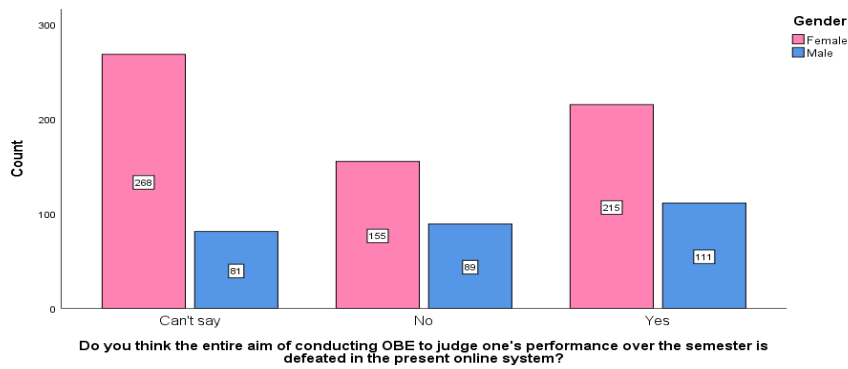


Fig 36: Gender wise Opinion of students in regards to OBEs being the Correct Tool to Judge Performance

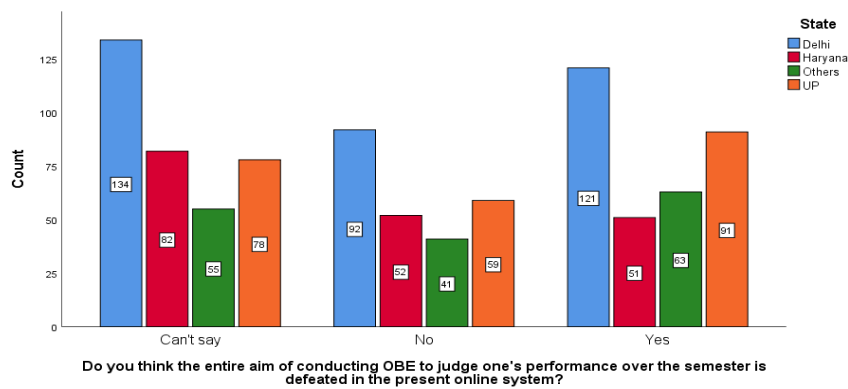


Fig 37: State wise Opinion of students in regards to OBEs being the Correct Tool to Judge Performance

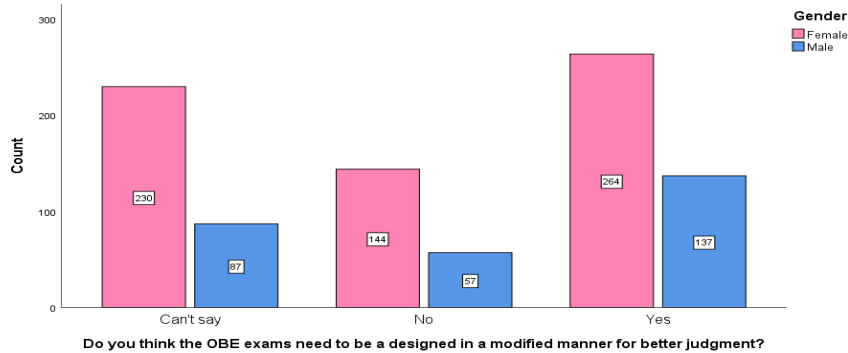


Fig 38: Gender wise opinion of students in regards to modification in OBEs

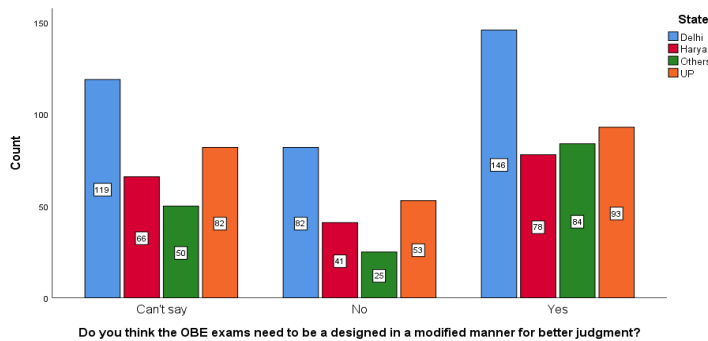


Fig 39: State wise opinion of students in regards to modification in OBEs

IV. REFLECTIONS AND FUTURE PERSPECTIVES

COVID-19 pandemic is far from over. Every day there is an increasing fear of emergence of a new variant. New warnings issued by World Health Organization (WHO) send out ripples of danger signals in the minds of people around the world. Health experts are predicting that a 'variant soup' has emerged which can cause havoc in the near future. Educationists, academicians, teachers and students are not untouched by this situation. It is quite evident that the vaccination drive in India has been extremely successful to protect the population from further variants of COVID-19. However with the upsurge of cases in China and United States (U.S.) and the ability of evolving variants to evade the immunity acquired by inoculation, the possibility of another wave cannot be completely ruled out. Although higher institutions are functioning full strength in India right now, the fear of outbreak of another form of the pandemic still looms large in the mind of the teacher-student fraternity. However, we cannot close our eyes and wait for another breakdown to happen. We must take the driver's seat and chalk out a backup plan that can diminish the effect of any catastrophic eventuality. One plausible solution is switching over to a blended or hybrid mode of learning in place of only resorting to traditional classroom learning. This approach would have triple benefits:

- (i) it would help both the students and teachers to strengthen their digital skills;
- (ii) it would be beneficial for teachers to do lesson planning in accordance with the online mode of teaching;
- (iii) it would assist academic institutions to gauge the need of students and teachers to allow for smooth functioning of virtual classes.

As noted earlier, blended learning finds a place in the 'New Education Policy' (NEP)-2020 and is all set to become the new normal. If we really want to come out with flying colours in adopting this novel innovation whole heartedly, then we must do some soul searching. The motto of blended learning should be 'Teach Everyone, Reach Everyone' so that every student gets a chance to be a part of the virtual classroom. COVID-19 pandemic transformed an outdated, obsolete and vintage higher education system in India into a contemporary, up-to-date and modern incarnation finely tuned with world education. However there was no time to prepare for this sudden transition and as a result loopholes could be found in the methodology. Thankfully, now we have already identified the shortcomings and this is the best time to rectify them. There have been some very promising aspects of this 'Cinderella Makeover' too and we need to build upon them to construct a full proof system.

V. Conclusion

We have presented an extremely comprehensive scenario review of the transitioning phase that higher education in India is going through. It is quite clear that if more pandemics or catastrophic events occur, blended learning and smart classrooms would be the future of higher education in India. It has been quite a journey from the traditional Classroom to the virtual classroom to the smart classroom. Indeed in the Seahore district of Madhya Pradesh State of India, all government schools have smart classrooms which have been built through contributions of teachers and residents. Similar initiative is the need of the hour in higher education at the national level.

The results of our survey are in harmony with this view. Our research highlights that students in Higher Education Institutions of India have applauded the online learning-teaching-assessment system emphasizing at the same time shortcomings such as lack of practical classes and unavailability of technology to check academic dishonesty during examinations. Our findings clearly reveal that these flag bearers of future India have a positive mood towards adopting blended learning as the mode of education in higher education. The 34 tests of association performed to gauge the mood of students to this giant leap of education and their gender and state bring out interesting results. Stark contrast can be seen in the opinion of male and females as well as students from different states in regards to opinion about various elements of teaching and learning experience during the pandemic. Also the choice of teaching mode in the future significantly varies with gender as well as state. Students from different states however do not differ visibly in regards to their level of satisfaction for teaching-learning-assessment during COVID-19. Similar views are echoed by males and females in regards to learning experience only. Both genders as well as students from various states show no association in their opinion about modification in the Open Book Examinations.

The rapid transmission of COVID-19 pandemic has demonstrated the significance of inculcating resilience to face various threats, from pandemic disease to extremist violence to natural calamities, and even, yes, rapid technological change. The pandemic has given us a chance to think about the skills that the students require in this ever changing unpredictable world such as informed decision making, ingenious problem solving, and perhaps above all, adaptability. To prioritize these skills for all students; resilience must be inculcated into our educational systems as well.

With the 5G technology to be launched in India from 1st October 2023, we will be a witness to learners and solution providers truly embracing the 'learning anywhere, anytime' concept of digital education in a multitude of formats. Conventional face to face classroom learning will be augmented with new learning

modalities - from live broadcasts to 'educational influencers' to Ed Techs to virtual reality experiences. Learning could become a habit that is imbibed into daily routines - a true lifestyle.

NEP-2020 has been implanted in Higher Education Institutes from the academic session 2022-23. Whether the changes made to the previous education system appeal to the present students can be delved upon in further studies.

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