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Challenges of unrestricted assignment-based examinations (ABE) and restricted open-book examinations (OBE) during COVID-19 pandemic in India: An experimental comparison

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Abstract

COVID-19 pandemic has affected every sphere of life specially the education sector observing a paradigm shift in the nature of pedagogy from offline face-to-face to online-virtual mode of learning. The biggest challenge in online-learning was the conduction of online examination for student's assessment specially in Indian context where digital divide is rampant. Thus, present study examines and compares the challenges faced by the students in two most widely accepted modes of examination by Indian universities and institutes of higher learning, that is, take home/unrestricted/assignment-based examination (ABE) and highly time restricted/open-book examination (OBE). Primary data was collected through questionnaires prepared by using Google forms to measure adaptability, satisfaction, and challenges using 5-point Likert's scale. Cronbach's α test was performed on question items to check the reliability and internal consistency of the items. χ^2 test has been applied in order to check whether there is a statistically significant relationship between the gender and place of residence in the acceptability of ABE and OBE. The findings suggest that both modes of examination have their own challenges largely governed by the digital and economic divide. The acceptance level of ABE and OBE is not associated with gender. However, we found the level of acceptance association of ABE with the place of residence of the students but not with OBE.

KEYWORDS
assignment-based exam, e-examination, e-learning, open-book exam

1 | INTRODUCTION

Due to COVID-19 pandemic the entire education system witnessed a paradigm shift in the pedagogy from offline face-to-face to online virtual mode of learning (Cuaton, 2020; Wang et al., 2020). Institutes of higher education are trying hard to cope with this paradigm shift but the bigger challenge in front of them is to explore alternative methods for secure and effective conduct of examination (Akimov et al., 2014; Sinha, 2020) because assessment in online education comes with numerous challenges (Sarrayrih & Ilyas, 2013). Initially, lockdown led to the postponement of examinations but as pandemic continued to stay the institutes were left with no choice than conducting online examination (Crawford et al., 2020). E-examination and assessment have their own advantages and disadvantages for institutions, educators and learners (Ilgaz & Adanir, 2020) because they are fully technology based. Online assessments are considered to be more superior to paper and pencil exam in the new normal (Sarrayrih & Ilyas, 2013)

Abbreviations: ABE, assignment-based exam; AVE, audio-viva exam; OBE, open-book exam; OPE, online-proctored exam; VVE, video-viva exam.

because they are considered to be more economical, environmental friendly, paper saving, improves management skills, immediate results, high security, autograding, automated record keeping (Bayazit & Askar, 2012; India Today, 2021; Parshall et al., 2002; Singh, 2021) ease to prepare exam schedule, administer students' authentication and validation and its effectiveness (Sinha, 2020). However, there are interregional and intraregional disparities in the adaptations of e-learning and e-examination because all the countries of the world are not equally endowed with e-resources to adopt e-learning and e-examination (Tamrat & Dmatew, 2020). Apart from lack of resources, low adoption of technology by the students (Randy, 2011), network connectivity issues (Farooq et al., 2020; Qazi et al., 2020; Xie et al., 2020), infrastructural disparity, digital divide, susceptibility to teaching are some of the challenges (India Today, 2021; Singh, 2021) which hamper the dissemination of uniform method of e-examination in all educational institutes.

Assessment is an integral part of education and teachers around the world are concerned to derive a dependable and relevant method of assessment (Ahmed et al., 2021) ensuring credibility and transparency (Natt et al., 2006), reliability, validity including summative and formative assignments (Hargreaves, 2007) with more emphasis on issues like security (Dendir & Maxwell, 2020; Rowe, 2004) legality, accessibility, student's identity (Gaytan & McEwen, 2007) and academic integrity (Gamage et al., 2020; Moralista & Oducado, 2020). As far as Indian education system is concerned, which is still exploring new ways for online examination; different institutions have adopted different modes of e-examinations. Indian institutions show diversity in methods of conducting online examination such as online-proctored exam (OPE), assignment-based exam (ABE), open-book exam (OBE), video-viva exam (VVE), and audio-viva exam (AVE). Normally there are two main types of online examination, the first is, OPE and the second is OBE. The OPE is not a new mode of assessment and it is in use since long in many undergraduate and postgraduate courses. In OPE, the students solve a question paper without cheating and are monitored by an examiner online (Draaijer et al., 2018; Fask et al., 2014) while in OBE the question paper is mailed to the candidates who also have freedom to take help of textbooks, classroom notes or any other sources. The logic behind such an examination is reasoning instead of recalling the facts (Tussing, 1951), thus the asked questions are more conceptual rather than factual (The Times of India, 2020). The OBE is further categorized into two types namely; *highly time restricted* (students get 2–3 h for solving and writing the question paper) or *take home/ABE* (time duration depends upon the concerned teachers). Take home ABE and AVE are nonproctored exams which do not have any invigilation. Fask et al., 2014 was of the opinion that when exams are nonproctored then there are more opportunities for children to cheat during the exams. On the other extreme, Hollister and Berenson (2009) in their study did not find any evidence of cheating during nonproctored exams.

Every field related to academics in general and fields experiencing speedy change in particular are needed to be constantly observed and monitored through research to fill the gaps created by the challenges (Creswell, 2003; Webster & Watson, 2002). This opinion provided the basis for the current research because Indian education system in general and the methods of e-assessments in particular are currently observing changes and facing numerous challenges from the part of institutions and students both. Conducting online examinations is a difficult task because students come from different geographical and socioeconomic backgrounds and most of them do not have access to e-resources needed for online examination. Students in rural areas are not very good at handling the technology thus in case anything goes wrong it would lead to great academic loss (Banchariya, 2021). Digital divide is also a major hurdle in smooth conduct of online examination. Thus, in the present paper we mainly tried to analyze the challenges faced by the students involved in take home/ unrestricted/ABE and restricted/OBE.

1.1 | Why ABE and OBE

In the present study we have compared two modes of examination, that is, ABE and OBE because the majority of educational institutes and universities were conducting assessment of the students through these two modes. The ABE and OBE have some similarities and differences and because of that the level of adaptability and satisfaction of the students are different. ABEs and OPEs both are similar in terms of monitoring because students were not monitored by any examiner either they were preparing assignments for ABEs or writing answers for OPEs. But both differ in terms of allotted time for writing the answer which plays an important role in students' adaptability and satisfaction toward examinations. In ABE students get enough time for assignment completion. But sometimes they had to submit more assignments as per the demand of the instructor creating problems for the students such as preparing multiple assignments for each subject at the same time, lack of resources and study material, lack of proper instructions and guidance by the educator, increased mental stress, and so forth. In ABE, the Internet connectivity is not a big issue because students get enough time to prepare and submit the assignments anytime before the deadline whenever the connectivity is good. In rural areas, even when the Internet networks are available, the speed remains too slow for uploading the assignments. In OPE, students write their answers from home and in this mode also time plays an important role because the students were allotted a time period during which they had to download the question papers and to write and upload the answers to the concerned university exam portal. This mode of examination also had some shortcomings such as poor Internet connectivity may delay in downloading of question papers and uploading of answer sheets become more difficult due to their larger file size, no acknowledgment received from the concerned institution, rurality further increases the difficulty and mental stress among the students. Thus, there is an urgent need to examine and analyze the challenges faced by the students in ABEs and OPEs so that the concerned authorities may figure out the solution for smooth conduct of e-examination during the pandemic. This will also help in decreasing the mental pressure from the students so that they can

concentrate better on their studies rather than thinking of the challenges which seriously affect their academic performance.

1.2 | Literature review

There are numerous studies which deal with the impact of COVID-19 pandemic on teaching and learning (Bisht et al., 2020; Harasim, 2000; Kummitha et al., 2021; Murgatrotd, 2020; Pokhrel & Chhetri, 2021; Sahu et al., 2020), psychological and emotional stress (Chhetri et al., 2021; Petrie, 2020; Son et al., 2020; Yang et al., 2021). COVID-19 pandemic has seriously affected the educational sector throughout the world and has also shifted the learning pattern from offline to online mode. Apart from e-teaching and e-learning, the most important challenge in front of the academic institutions is to assess the progress of students through various modes of assessment and examination. During COVID-19 various educational institutes have adopted different methods of conducting e-examination such as OBE, ABE and proctored exam. It is a debatable matter among the academicians that which method of e-examination is more suitable for students' assessment (Anaya et al., 2010). The ABEs and OBEs are the kind of examinations in which the students are allowed to consult textbooks, class notes and other available resources while writing the answer (Das, 2017). Traditional offline examinations (closed book exam) were testing the memory or the power to recall the facts but OBEs test the intellectual skills, creative and critical thinking of the students (Beena, 1998; Mohanan, 2021). There are two types of OBEs; the first is "*traditional sit down*" and the second is "*take home*" OBEs (Business Standard, 2020). In traditional sit down the students come to the institution and give an exam in front of an examiner though allowed to consult the study material. In take home OBEs, the question paper is handed to the students and they write answers at home. The OPEs could be further categorized into two more types; the first is "*restricted*" in which students are allowed to consult only some specific study materials preapproved by the instructor. The motto behind restricted OBE is to ensure that all the students are reading from the same books and notes to create equal opportunities for success and in "*unrestricted*" students are free to consult and bring what they want with no specific instructor direction (Crowdmark, 2021; Mohanan, 2021).

ABEs in comparison with OBEs were greatly accepted by the students and teachers because OBEs are believed to be discriminatory in nature for those who do not have Internet and other infrastructure, also for those who are economically poor and with disability especially students those who are visually challenged (Shankar, 2020). Other challenges related with the OBEs were receiving wrong question papers by the students and even after submitting the answer sheets to the portal the result was awaited because the answer did not reach to the concerned examination authorities due to human error (Ghosh, 2020). There are studies which favors the OBEs because it enhances the thinking potential and deeper learning of the students (Cain, 1979; Das, 2017; Feller, 1994; Moore & Jensen, 2007) through his own ability just by taking factual information from the books and class notes (Das, 2017), and are more realistic to the real-world practice (Feldhusen, 1961; Penninga et al., 2008) reducing their anxiety level as compared to closed book exams (Betts et al., 2009; Dale et al., 2009; Feldhusen, 1961). Students become more attentive in the classes so as to have a deeper and clearer understanding of the concept being taught (Rakes, 2008). But there are studies which show some negative outcomes of OBEs such as students dropping the class when they came to know that their exams will be open-book (Moore & Jensen, 2007), students given less time to study when exams were open-book (Agarwal & Roediger, 2011; Broyles et al., 2005), and they prepared themselves less when they knew that they were allowed to consult the books and other resources for writing answers (Block, 2012; Heijne-Penninga et al., 2010). There are studies which also suggest that we cannot compare the utility of open or closed book exams and a combined approach of exam would be more suitable for the students (Durning et al., 2016; Johanns et al., 2017). As far as ABEs are concerned they are used to test the higher cognitive abilities and the application of specific skills or knowledge. The output in an ABE could be tested by using sensory perception such as observing, reading and tasting (Utwente, 2021). There is also a close connection with e-examination and academic misconduct (Moralista & Oducado, 2020) such as cheating and plagiarism because of technology and Internet use (Marsh, 2017; Pena, 2012). There are studies which show that students and teachers believe that e-assessment makes cheating easier and more common (Kennedy et al., 2000; Mellar et al., 2018) but Stuber-McEwen et al. (2009) in their study found that the possibility of cheating in online mode of teaching is less than face to face mode.

Another important issue that has been observed in the past literature was related to gender and education. Gender plays an important role in the acceptance and adaptation of online learning and in Indian context gender differences cannot be overlooked because of traditional mindset (Gender inequality in India, 2017) inequalities on the basis of gender and caste (Desai et al., 2010) less optimistic nature of females toward modern technology and use of computers (Tondeur et al., 2016). Numerous literatures are available on role of gender and e-learning in which it is documented that males are more familiar with the use of new media and computers than their female counterparts (Goswami & Dutta, 2016). But as far as the role of gender is concerned in e-education one school of thought believes that e-learning leads to discrimination against females (Astleitner & Steinberg, 2005; McSporran & Young, 2001). Equal opportunities are not available to all students because of difference in performance due to gender (Ballen et al., 2018). Second school of thought promote the idea that e-education is more flexible and enhance interaction in favor of females (Anderson & Haddad, 2005; Bruestle et al., 2009). Scarce empirical studies are available on role of gender on acceptability and satisfaction of e-examination/assessment. However, a study by Bisht et al. (2020) shows that acceptability and satisfaction of ABE was more in female than male students. Adanir et al. (2020) observed that e-examination was more stressful for female students keeping them at disadvantageous position as compared to males and male students were in favor of replacing e-examination with offline paper-based

examination. The acceptability of e-examination due to cheating concern was a matter of much concern for female than male students. Elmehdi and Ibrahem (2019) conducted a research in UAE where no difference was observed in perception toward e-examination due to gender but Kundu and Tripti (2021) in a study on Indian students observed that male students have better perception than female.

Moreover, in Indian context, the place of residence also plays a significant role in the acceptability and satisfaction of students toward online examination because of large digital and economic divide among the students between rural and urban areas and it should be taken as a matter of concern. Dhawan (2020) opines that students who belong to poor economic background and low tech-savvy families are at disadvantageous position during online education. The statistics by National Sample Survey Organization (2017–2018) shows that less than 15% of the rural households have internet access in comparison with 42% of the urban households in India (Modi & Postaria, 2020). Some states in India like Kerala and Andhra Pradesh has provided 50% and 30% internet accessibility to its rural population but only 30% and 2% have internet access at home, respectively. In case of urban areas the condition is not very good because the states like West Bengal and Bihar have only 21% and 18% internet accessibility to its urban population at home (Mukhopadhyay, 2020b). The literature and data shows that in a condition when students do not have access to basic technology and are unable to attend the classes, in a similar condition they obviously face a lot of difficulties during e-examination and e-assessment. At international level few past studies concluded that 88.4% of the students prefer to be assessed online (Donovan et al., 2007) and 92% of the students were of the opinion that e-assessment assisted their learning (Gilbert et al., 2011). But, in Indian context similar studies are a rarity thus, current article tries to investigate the student's perception on acceptability, satisfaction and challenges faced during various modes of examination opted by their institutions in India. The review shows that a wide literature has been published about the COVID-19 pandemic impact on open-book restricted, open-book unrestricted examination (Eilersten & Valdermo, 2000; Brightwell et al., 2004; Gharib et al., 2012; Rummer et al., 2019; Zagury-Orly & Durning, 2020; Ashri & Sahoo, 2021;) and OPEs (Hylton et al., 2016; Kharbat & Daabes, 2021; Milone et al., 2017) worldwide but very limited studies are available on the effect of pandemic on contemporary modes of examination. On the basis of the research gap following objectives and hypothesis have been frames and analyzed.

1.3 | Objectives of the study

The present study is an attempt to draw out answers to the following research questions:

- Challenges faced by the students in in online/virtual classrooms.
- Difficulties faced by the students during ABE and OBE.
- To get the feedback from the students on alternative methods of assessment and other academic issues such as academic dishonesty and misconduct.

1.4 | Hypothesis of the study

The following hypothesis were formulated and tested with the data using χ^2 analysis:

- The students' gender affects the acceptability of ABE.
- There is an association between the acceptability of ABE and students' place of residence.
- There is an association between the satisfaction level of OBE and the students' gender.
- The students' place of residence affects the acceptability of OBE.

2 | MATERIALS AND METHODS

A cross-sectional analysis was undertaken to analyze the repercussions of COVID-19 pandemic on the adaptability and satisfaction of students' during e-examination and e-assessment. The questionnaire was drafted to measure the adaptability, satisfaction, and challenges using 5-point Likert's scale items in four distinct groups namely; online/virtual classroom (OVC), ABE, OBE, and other examination-related issues. 5-point Likert's scale is commonly used to measure constructs such as attitude toward different things, acceptance, and satisfaction, and so forth, where 1 resemble strongly disagree with a particular statement, 2—disagree, 3—neutral, 4—agree, and 5—strongly agree.

2.1 | Research instrument

An online questionnaire was designed with the help of students whose contact numbers were easily available. The researchers took the help of 12 students (six from undergraduate and six from post-graduate courses) and three faculties for discussing and analyzing the problem related to online examination and e-assessment. Three students from each level had appeared in OBE and ABE. The discussion provided an insight to frame the questions related to the challenges experienced by the students. We also conducted a pilot survey employing convenience sampling techniques for testing the questionnaire. Initially, 25 questionnaires were obtained from the students and all the items in the questionnaire were analyzed and subjected to item analysis. The questionnaire items with low Cronbach's α value were removed. The final questionnaire was prepared after testing reliability on the basis of Cronbach's α value. Moreover, a similar test was also performed to see if multiple questions Likert's scale survey is reliable or not because it measures internal consistency of the items. Majority of the items in the questionnaire were closed-ended as per Likert's scale requirement but few questions were open-ended to get more

information on the challenges faced by the students and accordingly the questionnaire was divided into four sections:

1. The first section focused on the information related to their social and academic background such as gender, place of residence, course category, course level, class year, and so forth.

2. The second section focused on the challenges experienced by the students while attending the virtual/online classroom.

3. Third section focused on the challenges of the students in ABE and OBE and their views on other modes of examination.

4. Fourth section carries items that dealt with the students' opinion on other academic issues like skills and academic dishonesty.

2.2 | Data analysis

The data were collected through an online questionnaire using Google Forms. The link of the questionnaire was sent to the students primarily through WhatsApp, e-mails, Facebook, and other social media platforms. The country is currently going through a lockdown due to the second wave of COVID-19 and students are attending the classes from home. The second wave of COVID-19 was infectious and fatal thus it made the task difficult for the researchers to reach the students of different universities and institutions to participate in the survey. Thus, we opted for a snow-ball sampling method and conveyed the students of our university to circulate the same questionnaire to the students of other institutions as the students generally have good social networks among themselves. The minimum requirement in giving the response of the questionnaire was that the student must be enrolled in graduate and postgraduate courses and currently attending the online classes. In order to have a balanced view, both urban and rural background students were considered in our sample to analyze the challenges faced by rural and urban students (place of residence).

We have also conducted an online interview of 40 students, 10 undergraduate and 10 postgraduate from rural and similar numbers were taken from urban backgrounds in order to have a better understanding and balanced view. The interview questions were related to the (i) challenges that students were facing during ABEs and OBEs, (ii) which method of exam is a better option other than these two exams, and (iii) why students are not satisfied with ABE and OBE. χ^2 test has also been applied in order to check whether there is a statistically significant relationship between the gender and place of residence in the acceptability of ABE and OBE or not. The survey was carried out for a period of 10 days from May 17 to 27, 2021. A total of 708 complete responses were received and incorporated out of 719 questionnaires.

3 | RESULTS AND DISCUSSIONS

3.1 | Respondents' demographics

In the present study, 708 questionnaires were incorporated which were received from various universities and institutes of higher education in India (Table 1). Out of total respondents, 518 (73.2%) and 190 (26.8%) belonged to undergraduate and postgraduate courses, respectively, and were in different program years. The reason for including postgraduate students in the study was that they are in the advanced stage of study and are academically more mature and have a better understanding of the problems as compared to undergraduates. The largest proportion of the students who participated in the study were from social science (34.7%), arts (34.5%), and science (19.5%) backgrounds. Students from all the streams were targeted to

TABLE 1 Educational and demographic characteristics of the respondents ($n = 708$)

S. No.	Variables		*n*	(%)
1	Institution name			
a	Jamia Millia Islamia		336	47.5
b	Aligarh Muslim University		144	20.3
c	Delhi University		76	10.7
d	Banaras Hindu University		62	8.8
e	Jawaharlal Nehru University		42	5.9
f	Others		48	6.8
2	Gender			
a	Male		366	51.7
b	Female		342	48.3
3	Program category			
a	Social science		246	34.7
b	Arts		244	34.5
c	Science		138	19.5
d	Engineering		36	5.1
e	Commerce		14	2.0
f	Others		30	4.2
4	Program year			
a	1st Year	Graduate	268	37.9
		Postgraduate	124	17.5
b	2nd Year	Graduate	112	15.8
		Postgraduate	58	8.2
c	3rd Year		110	15.5
d	4th Year	Graduate	12	1.7
		Postgraduate	2	0.3
e	5th Year	Graduate	18	2.5
		Postgraduate	4	0.6
5	Course level			
a	Undergraduate		518	73.2
b	Postgraduate		190	26.8
Mode of examination				
a	Open-book examination		452	63.8
b	Assignment-based examination		256	36.2
6	Place of residence			
a	Urban		442	62.4
b	Rural		266	37.6

have a diverse opinion regarding the challenges faced by them during e-examination. Students who belonged to rural areas accounted for 37.6% and the rest 62.4% were from urban areas. Place of residence (rural and urban) holds much importance in Indian context especially in connection with e-learning and e-examination because of rampant digital divide and economic divide. Among total students, 366 (51.7%) were males and 342 (48.3%) were females. Analyzing the role of gender in adaptability and satisfaction of the e-exam holds much importance because males are generally not accustomed to the home environment for e-learning and e-examination whereas females do.

3.2 | Students' perception toward OVC

The condition of e-learning in India portrays a grim picture because India is characterized by high regional digital divide and gender digital divide which is the biggest challenge in promoting e-learning. India has the world's 12.0% of Internet users yet more than 50.0% of its population lacks Internet access (Beniwal, 2020). The National Sample Survey (NSS) data for 2017 reveals that 14.9% of the rural households have access to the Internet as against 42.0% of the urban households and only 4.4% of the rural households have a computer against 14.4% of urban households. Approximately 13.0% of the people in rural areas over the age of 5 years were capable of using the internet against 37.0% in urban areas (Pandey, 2020). The NSS data shows that, out of total students, only 12.5% have internet access at home and at disaggregate level only 5.0% of the rural students have internet access at home against 27.0% of the urban students (Mukhopadhyay, 2020a).

Results of the survey show that more than half, that is, 414 (58.5%) of the students were facing some kind of problem related to internet connection (Figure 1). The mean of the VOC1 is 3.55. Hence, it means that the majority of the students were agreeing that they face Internet connectivity problems (Table 2). Out of 414 students, 42.0% of the students were from rural areas and the villages here have poor Internet infrastructure. Among the total rural (266) and urban students (442), 67.42% and 53.39% of the students agreed to have internet related problems, respectively. When students were at university, then 85.0% of the urban students had access to the internet through university computer labs and Wi-Fi but when urban students are at home the share comes to 41.0% and only 28.0% of the rural students have access to Internet at home. This situation is a matter of much concern because almost 55.0% of the students enrolled in universities come from rural areas. Lack of proper internet access was the reason that almost 60% of the students were facing difficulty in browsing/searching the study material online and this was confirmed because the mean value for VOC6 was 3.64 hence, the majority was facing a browsing related problem (Table 2). Approximately 80% of the students (the mean value for VOC2 was 4.08) were of the opinion that due to e-learning there was little scope for student–teacher interaction and they were not able to clear the concept of topics taught in the class. Hunter et al. (2003) argues that student–student and teacher–student interaction is the crux of effective e-learning. Group discussion and interaction of the students with the teachers as well as with their classmates during offline mode help students to have a better and deeper understanding of the subject. Reduction in the contact hour for students and lack of counseling from teachers makes understanding and learning a difficult process. During online interviews, it was observed that students have created an unofficial WhatsApp group (class and subject wise) in which they use to interact among themselves and in case if teacher's help is needed then they can interact in the official groups.

Our findings suggest that students were not in favor of online lectures because 82.5% of the students were of the view that they were not able to concentrate in the class and 80.5% of the students felt difficulty in absorbing the maximum of the content delivered online (Figure 1). Poor Internet connectivity, distractions, and lack of study environment at home because students do not have private/quiet space and presence of siblings nearby were the main reasons for the distraction. Moreover, the majority of the students were attending the classes through cell phones and they often got calls or messages in between the lectures which was another distracting factor. Thus, it is suggested that attending classes through a laptop would be a better

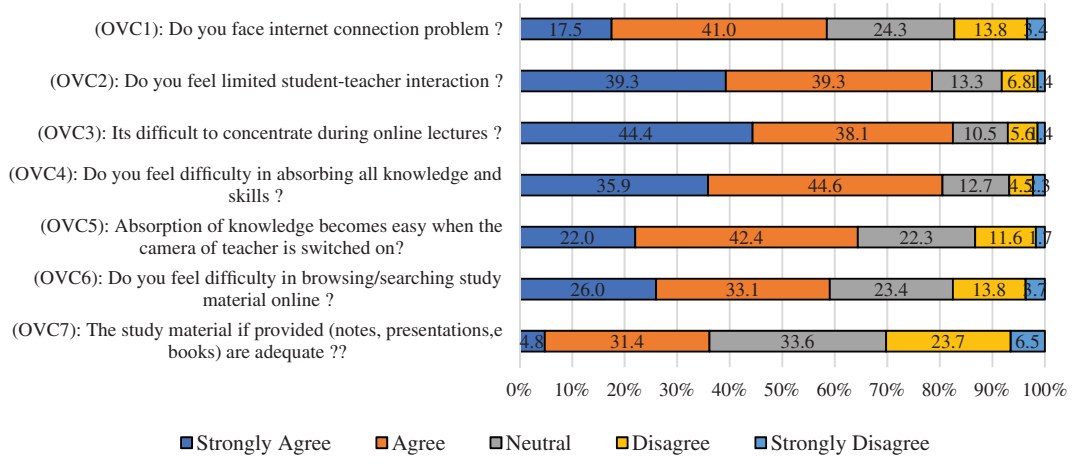

FIGURE 1 Showing the results in percentage (%) for items on online/virtual classroom from 5-point Likert's scale with the help of diverging stacked bar ($n = 708$)

TABLE 2 Mean and standard deviation values for the questionnaire items

Section I (online/virtual classroom)	Mean	Mean2	SD
OVC1	3.55	13.71	3.19
OVC2	4.08	17.58	3.67
OVC3	4.18	18.37	3.77
OVC4	4.07	17.46	3.66
OVC5	3.71	14.78	3.33
OVC6	3.64	14.49	3.29
OVC7	3.04	10.26	2.69
Section III (assignment-based examination)	**Mean**	**Mean2**	**SD**
ABE1	3.61	13.98	3.22
ABE2	3.52	13.36	3.14
ABE3	3.28	11.80	2.92
ABE4	2.78	9.00	2.49
ABE5	3.80	15.34	3.40
ABE6	3.31	12.13	2.97
ABE7	2.88	9.50	2.57
ABE8	2.86	9.64	2.60
ABE9	2.98	9.87	2.63
Section III (open-book examination)	**Mean**	**Mean2**	**SD**
OBE1	2.78	8.97	2.49
OBE2	2.79	8.82	2.45
OBE3	3.34	12.43	3.02
OBE4	3.37	12.85	3.08
OBE5	3.81	15.81	3.46
OBE6	3.14	11.27	2.85
OBE7	2.41	7.09	2.16
OBE8	2.49	7.63	2.27
Section IV (other academic issues)	**Mean**	**Mean2**	**SD**
OAI1	3.42	12.65	3.04
OAI2	2.31	6.46	2.04
OAI3	3.50	13.28	3.13
OAI4	3.94	16.48	3.54

option. The mean value observed for VOC3 and VOC4 (Figure 1) was 4.18 and 4.07 (Table 2), respectively, which shows that the inclination of the majority of students toward online classes was low. Approximately 65% of the students responded that the absorption of the knowledge increased when the camera of teachers was in switched on mode. Almost 30% of the students responded that the study material provided by the teachers was not adequate and 33.6% of the students were neutral. The mean value for VOC7 was 3.04 hence; it means that the majority of the participants were neutral. When enquired about the information about e-learning websites and resources which assisted them to study from home, their responses were as follows: 30.8% had no information, 35.9% said yes, and 33.3% was not sure. In India there are some important government owned websites that provide e-learning material to various undergraduate and postgraduate students free of cost, for example, SWAYAM MOOCs, CEC-UGC YouTube channel, National Digital Library, e-PG Pathshala, and so forth. From among these online teaching and learning resources approximately 17% of the total students knew about e-PG Pathshala and CEC-UGC YouTube channel followed by 12.2% of the students who knew about SWAYAM MOOCs, only 7.1% knew about National Digital Library. Majority of the students (47.74%) were using some other online resource websites for learning and preparing for exams.

3.3 | Perception of students toward ABE

In this section of the article, we analyzed the challenges faced by students who have appeared for ABE. Out of a total 708 students, 256 students (36.2%) appeared for ABE (Table 1). Present study took the opinion of students on the number of assignments requested to

them for passing the semester exam. Almost 60% of the students said that the assignments requested to them were too many and 57.8% of the students were of the opinion that the time allotted for the preparation of assignments was also limited (Figure 2). The mean value for ABE1 and ABE2 was 3.61 and 3.52, respectively (Table 1); hence, the majority of the students agreed with the question items ABE1 and ABE2. Submitting multiple assignments within a short period of time with poor Internet facility made the examination process too cumbersome for the students.

The main issue raised by the students on ABE was that it failed to assess the real potential and they were preparing assignments from the same book or the study material provided by the teachers. Most of the time students were just busy in writing the assignments without proper and in-depth readings on the topics. More preference was given to writing rather than skills. The students were of the opinion that assignments were to be completed on a very short notice and it becomes a very tedious and hectic task to do so amidst the pandemic, especially if family members are ill. Almost one/third of the students were informed that the instructions on the quantity (word limit) and quality of assignments was not clearly mentioned thus, it was more difficult for them to prepare. The mean value for ABE4 was 2.78 hence; the majority of the students were having neutral opinions. The quality of assignment which teachers expect from students with respect to the information it carries differs thus, feedback becomes necessary from the teachers so the students could analyze and improve themselves. Thus, when we enquired from the students that they have received any feedback from the teachers on the about submitted assignments 42.2% responded never, 48.4% said sometimes, and only 9.4% responded always. Moreover, poor Internet connectivity created problems for the online submission of the assignments, our data indicates that submission was difficult for 33.6% students; whereas the majority (64.1%) of the students found this process easy and remaining 2.3% did not submit the assignments due to various reasons. Apart from that, a student on average has six papers and on average they have to prepare four assignments which leads to a total of at least 24 assignments. It becomes monotonous and eventually takes precious time which could have been utilized for self-study. Sitting in front of the screen for hours and then making handwritten assignments in a short-time span is definitely not a great way to judge a student's potential and caliber. Lack of information on e-resources and difficulty in searching the content made it difficult for the students to collect literature for the preparation of assignments.

In the ABEs, students felt writing the same thing for assignment which was given in the textbooks is useless and it promotes plagiarism as they copied the material from other sources. ABEs were really hectic and there is no intellectual benefit for students than just scribbling for better marks. Students belong to different socioeconomic backgrounds thus, they opined that purchasing every book was not possible for them and they spend most of their time in searching the material online. Since most of the students prepare their assignments at home almost from the same book and online resources thus the average students also get good grades. This was the reason that 67.2% of the students agreed that ABE does not evaluate the potential of students (Figure 2) and it was statistically supported because the mean value for question item ABE5 was 3.80 (Table 2). When asked about their own mode of examination, 46.1% were of the opinion that ABE was not suitable, but the mean value (3.31) shows that the majority of the students were having neutral opinion regarding item ABE6.

3.4 | Opinion of ABE's students on other possible modes of e-examination

In this part of the study, we took the opinion of ABE's students on other modes of examinations. About 34.4% and 37.5% of the students

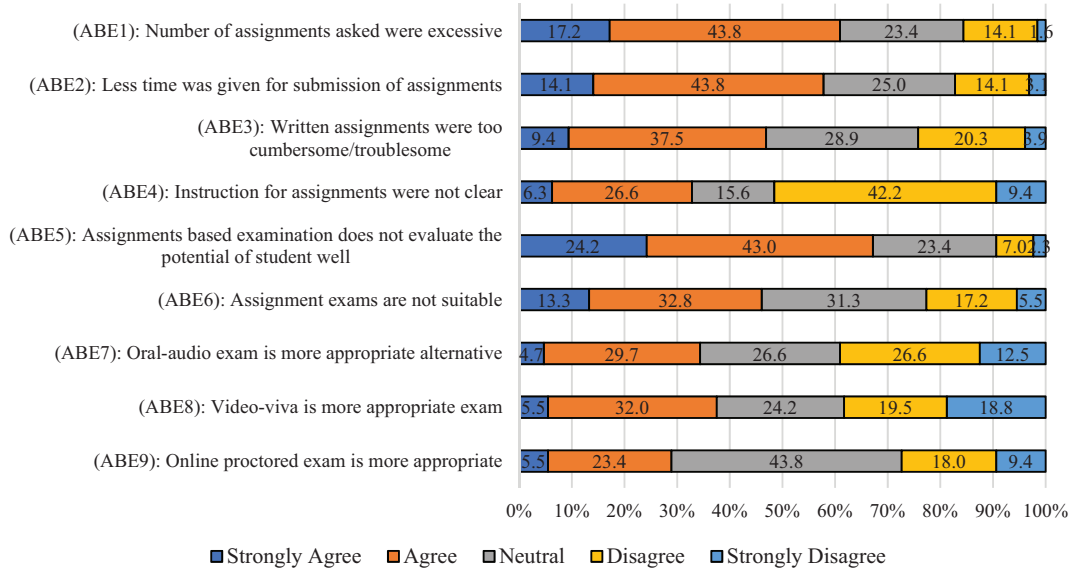

FIGURE 2 Showing the results in percentage (%) for items related to challenges faced by the students during assignment-based examination (ABE) from 5-point Likert's scale with the help of diverging stacked bar ($n = 256$)

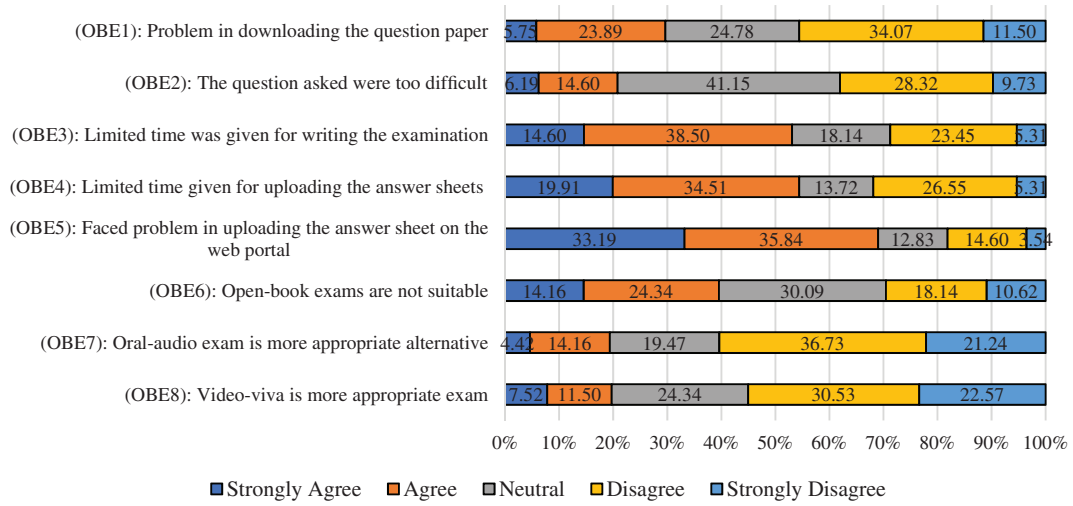

FIGURE 3 Showing the results in percentage (%) for items related to challenges faced by the students during open-book examination (OBE) from 5-point Likert's scale with the help of diverging stacked bar ($n = 452$)

were of the opinion that oral–audio exam and VVEs are more appropriate, respectively (Figure 2). Through online AVE and VVE teachers can evaluate the abilities and skills in a better way and there is no scope left for academic dishonesty on the part of students. During online interviews it was found that some students facilitate other students by providing their assignments and other students bring some minor changes without putting much effort in creating their own assignments. The mean value for question item ABE7 and ABE8 is 2.88 and 2.86, respectively, which reveals that the majority of the students were having average responses for said item (Table 2). Least number of students (28.9%) agreed for OPE because in comparison with ABE, OAE, and VVE, the OPE requires more online resources and a slight mistake in following the protocols of proctored exams lead to the cancelation of candidature of students affecting their academic future. The mean value (2.98) shows that the majority of the students were also neutral for item ABE9. ABE students believed that OBEs are better than the ABEs because OPEs do not demand a large number of assignments to be submitted and students appearing for OBEs have to write only during the exam hours and get extra time for uploading of answer sheets.

3.5 | Perception of students toward open-book e-examination

This section of the article examines the challenges experienced by the students who appeared for open-book online examinations. Out of a total 708 students, 452 students (63.8%) appeared for OBEs. Thus, this part shows only the view of 452 students. In an OBE question paper was distributed among the students through emails, after writing the answers students took the pictures of answers sheets and uploaded them on the concerned university's exam portal. OBE requires high-speed Internet for downloading the question paper and uploading the answer sheets. Thus, when asked about the problem related to downloading, 29.6% of the students agreed that they faced a problem (Figure 3). But the mean value for OBE1 was 2.78 shows that the majority were neutral in their opinion on OBE1 (Table 2). OPEs focus more on critical thinking and analysis rather than remembering information and it develops student's ability to recall and relay the information quickly thus, the question asked in OPEs is a bit conceptual and tough so that they cannot copy the answer directly and easily from the book. Approximately 20% of the students responded that the question asked in the examination was too difficult but the mean value (2.79) for OBE2 shows neutral opinion. In online mode, the level of questions was more or less similar to normal offline exams. Writing conceptual answers requires more time than nonabstract questions but study shows that questions were not tough, however, 53.1% of the students were of the view that allotted time for writing the answers was less (Figure 3). As students recently shifted from offline to online mode and are not familiar with OPE thus, time management in combination with technological challenges became an issue to write answers. OBE requires high uninterrupted Internet service because students have to upload their answer sheets within a defined period of time. Since Internet facilities are not good on that 69.0% of the students agreed in uploading the answer sheets on the university exam portal. The mean value for OBE5 was 3.81 shows that the majority were agreeing with the fact that they incurred a problem.

Though they faced problems in uploading but when enquired about the time allotted for writing and uploading of answer sheets a neutral opinion was found with the mean value of 3.34 and 3.37 for items OBE3 and OBE4, respectively. The reason was universities provided extra time for uploading the answer on which 63.8% students confirmed. Moreover, though study shows that 38.5% of the students found their own mode of examination (OBE)

unsuitable that shows a neutral opinion for the item OBE6 having mean value 3.14.

3.6 | Opinion of OBE's students on other possible modes of e-examination

In this part of the study, we took the opinion on other possible modes of examination by including only those students who appeared for OBE. Our finding suggests that almost two/fifth of the students from OBE believed that oral–audio mode and video-viva mode of exam is a much better alternative method of assessment (Figure 3). For both the items, that is, OBE7 and OBE8 the mean value was 2.41 and 2.49 which shows majority of the students disagree with the items that OAEs and VVEs were more appropriate that OBE (Table 2). During the online interview it was found that students were already in mental stress due to COVID-19 infection and exam time further increased their anxiety level. Thus, they preferred to be assessed through OPE because accessibility to subject material during exams help to increase their performance just by lessening their exam anxiety. Moreover, in OPEs they do not have to face their instructor either through voice-to-voice or face-to-face as in OAE and VVE, respectively, the fear of being interviewed by the teacher makes them more vulnerable to exam stress.

3.7 | Opinion of student's on other academic-related issues

Present study also took a combined opinion of the students who appeared for OPE and ABE and it interestingly found that almost half of the students (51.1%) believed that both the methods of examinations were impractical in comparison with regular offline mode (Figure 4). The mean value for item OAI1 is 3.42; hence, it shows that the majority of the students agree with the item (Table 2). It is a common belief that when students shift there from offline to online mode of learning and assessment then their computer related skills will be enhanced especially by those who belong to the rural areas of the country. Students will search out study material online themselves, they will come to know about various online resources providing knowledge and information about different streams and subjects, their technological literacy will increase leading to decrease their dependency on offline learning and assessment. But study found that 63.0% of the students disagree with the statement that online examination and learning contributes to their skill enhancement. The mean value for item OAI2 is 2.31 which show that students disagree with the fact that online examinations help in increasing the skills. About 56.2% of the students responded that online exams were an easy option for getting good marks especially when they are assignment-based and open-book (Figure 4). This may be the reason that 72.9% of the students said that online exams of such type promote academic dishonesty in the form of cheating, fabrication, facilitation and plagiarism. Some topics in the curriculum were new and lack of related reading material online increased the dependency of students on few fellow mates to copy down the assignments pretending it to be their hard work which truly is not. OPEs are totally different because the students were constantly monitored by an examiner throughout the exam. The mean value for items OAI3 and OAI4 is 3.50 and 3.94, respectively, hence, majority of the students were agreeing of the fact asked in items (Table 2).

One problem found to be common in both types of exams was the Internet connectivity issue. In the OBE also students faced a lot of problems while downloading question papers and uploading answer sheets. Another important issue related to the OBE as reported by the students was the clicking of too many pictures of answer sheets. Cropping, rotating, and sorting took much of their time and often the pictures taken from the mobile phone were unclear because students cannot afford high-end mobile phones with good camera quality. Converting images in suitable portable document format with desired file size was hectic and time consuming. Since all the students were giving exams at the same time, uploading answer sheets at the same time increased the load on the server which failed to complete the process and then the students had to repeat the process. Even while writing the answer the thought of uploading the answer sheet was constantly disturbing the students creating panic and anxiety increasing the chances of getting the wrong answer uploaded at the wrong place. The study finds that 41.2% of the students were of the opinion that the level of mental pressure in online OBEs was higher than normal

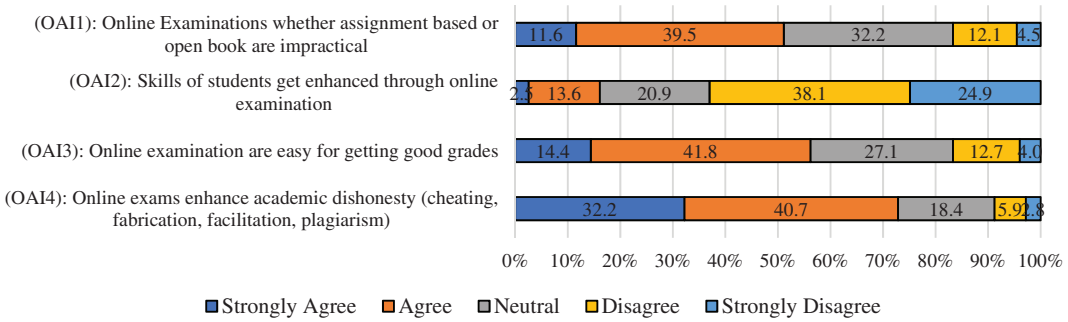

FIGURE 4 Showing the results in percentage (%) for items related to other academic issues from 5-point Likert's scale with the help of diverging stacked bar ($n = 708$)

TABLE 3 Gender wise frequencies of respondents in different levels of acceptance for assignment-based examination

Levels of acceptance						
Category	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Total**
Rural	11	24	23	14	5	77
Urban	6	18	16	9	2	51
Total	17	42	39	23	7	128

offline mode examinations and 26.5% of the students believed that the pressure was more or less the same. No acknowledgement was received from the university authorities whether the answers sheets have been properly uploaded and received. At the time of declaration of results the students came to know that their answer sheets were not uploaded and submitted to the online portal, hence, not received by the concerned authorities and students failed the exam. Students also raised the issue of average marking by the teachers which lowers the morale for putting more effort in writing better answers during future online examinations. Distracted home environment was also not suitable for an OBE because students have to do a lot of work before submission such as clicking the photos and uploading the answers in a limited time period. ABE was more problematic for those students who belonged to remote rural areas living under constant pressure thinking whether they would be able to upload the answer sheets or not.

After discussing the primary statistics, we now analyze the hypothesis statistically. We analyzed whether the satisfaction level of the students on the modes of examination their institutions opted has some association with their gender and place of residence or not. We applied a χ^2 independence test for testing a few categorical variables for some relationship at 5% level of significance in all the cases.

1. Whether the acceptance level of ABE has some dependency on gender or not?

Following null hypothesis was framed to work out for the query above.

H_0. Acceptance level of ABE is independent of gender.

H_1. Acceptance level of ABE is not independent on gender.

Observed frequencies are shown in Table 3 in various levels of satisfaction. After applying the χ^2 test, we get χ^2 (chi value) $= 0.705$ (degree of freedom taken is 4) and χ critical number (α value) $= 9.487$. Smaller χ^2 shows that the null hypothesis at 5% level of significance is accepted. The data reveals that the *level of acceptance of ABE is not associated with gender*. We can also have a comparison between genders of students for their level of satisfaction who gave ABE (Table 3). Figure 5 shows a comparison between the proportion of female and male students in each level of acceptance.

2. Whether the acceptance level of ABE has some dependency on place of residence?

To find out the answer of above query we formulated following hypothesis:

H_0. Acceptance level of ABE is independent of place of residence.

H_1. Acceptance level of ABE is not independent on place of residence.

Observed frequencies are shown in Table 4 in various levels of acceptance. In this case, the chi value we get was 12.274 which was greater than the χ-critical value (9.487) hence, the hypothesis was rejected at 5% level of significance. The finding shows that the *level* of acceptance *of ABE is associated with the place of residence*. A comparison between rural and urban students for their level of acceptance of ABE is shown in Table 4. Figure 6 shows a comparison between the proportion of rural and urban students in each level of acceptance and it reveals that urban and rural students both were not in favor of ABE.

3. Whether the satisfaction level of OBE has some dependency on gender or not?

Following null hypothesis was framed to work out for the query above.

H_0. Acceptance level of OBE is independent of gender.

H_1. Acceptance level of OBE is not independent on gender.

In this case, the χ value (0.514) is lesser than the χ critical value (9.487) hence, we accept the hypothesis. The finding shows that the *level of acceptance of OBE is not associated with the gender of the students*. From Table 5 we can compare the acceptance pattern of OBE for female and male students. Figure 7 shows female and male students in each acceptance pattern.

4. Whether the acceptance level of OBE has some dependency on place of residence?

To find out the answer of above query we formulated following hypothesis:

H_0. Acceptance level of OBE is independent of place of residence.

H_1. Acceptance level of OBE is not independent on place of residence.

The calculation shows that the observed χ value (2.719) is smaller than the χ critical value (9.487); hence, we accept the hypothesis. The finding shows that the *level of acceptance of OBE is not associated with the place of residence'*. From Table 6 we can compare the acceptance pattern of OBE for urban and rural students. Figure 8 shows female and male students in each acceptance pattern.

4 | CONCLUSIONS

The effect of COVID-19 lockdown on Indian education system was severe primarily because of digital divide and lack of Internet infrastructure across the regions, across the communities and across the gender as well. Students lack e-resources such as laptops, Wi-Fi, high-speed Internet connections etc for uninterrupted online lectures. Study concludes that there was lack of teacher–student interaction

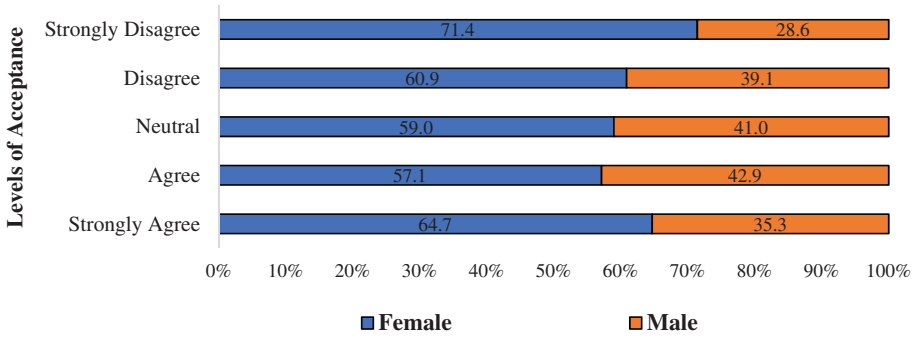

FIGURE 5 Gender wise comparative level of acceptance to ABE. ABE, assignment-based examination

TABLE 4 Detected frequencies of rural and urban respondents in different levels of acceptance to assignment-based examination

Levels of acceptance						
Category	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Total**
Rural	9	13	5	7	4	38
Urban	8	28	35	16	3	90
Total	17	41	40	23	7	128

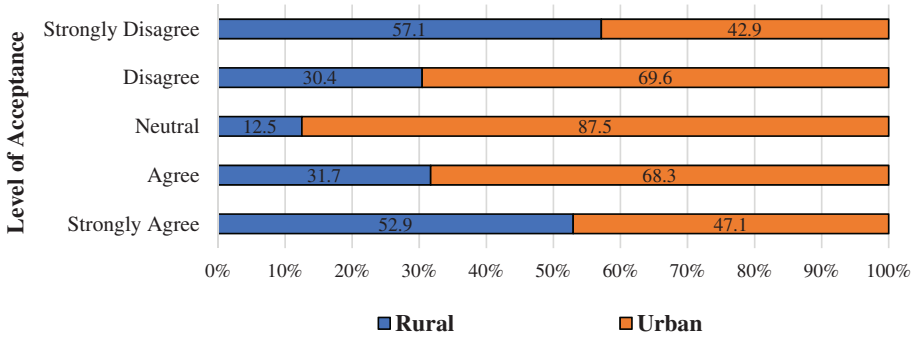

FIGURE 6 Comparative level of acceptance to ABE by rural and urban students. ABE, assignment-based examination

TABLE 5 Gender wise detected frequencies of respondents in different levels of acceptance to open-book examination

Levels of acceptance						
Category	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Total**
Rural	14	24	30	16	10	94
Urban	18	36	38	26	14	132
Total	32	60	68	42	24	226

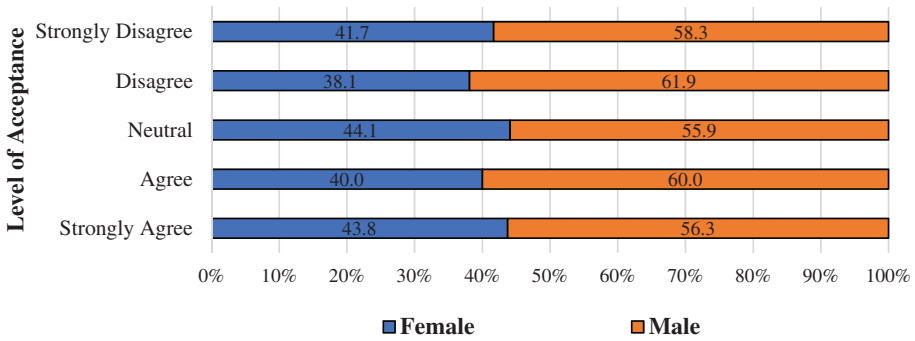

FIGURE 7 Gender wise comparative level of acceptance to OBE. OBE, open-book examination

and absorption of knowledge during lectures; thus, teachers should devise some means in order to have a better interaction with the students through adopting modern teaching platforms making their lectures more interesting. Students were not satisfied with the study material provided by the teachers and they too were not aware about the e-learning material available online. Students giving exams

Levels of acceptance						
Category	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	**Total**
Rural	16	24	30	17	7	94
Urban	16	36	38	25	17	132
Total	32	60	68	42	24	226

TABLE 6 Detected frequencies of rural and urban respondents in different levels of acceptance to open-book examination

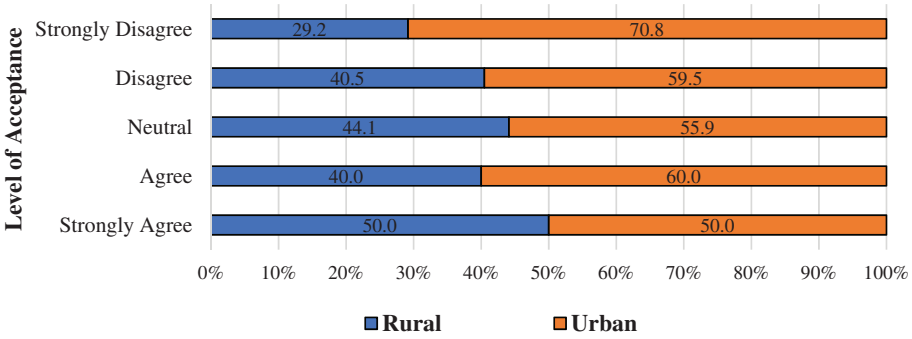

FIGURE 8 Comparative level of acceptance to OBE by rural and urban students. OBE, open-book examination

through assignment-based mode were not satisfied because they believed that this mode of exams were not able to judge the real potential and are thus biased giving average grades. On the other hand, students giving exams through open-book mode were also not in favor because they were of the opinion that OBE is not imparting knowledge and promoting academic dishonesty on the part of students. OPEs are a better option for improving the standard of e-examination and e-assessment but it requires two-sided effort; one from the institutes of higher education's and second from the government to invest and develop e-infrastructure. Majority of the students belong to lower socioeconomic backgrounds thus the situation related to e-resources accessibility is not going to be over soon. Thus, the government should come up with plans to provide highly subsidized smart phones and laptops to the students. Much care should be taken regarding dissemination of Internet infrastructure in rural areas with more emphasis on data recharge plan because data exhaustion during the classes was also an important issue. Government must provide a student-recharge plan on a highly subsidized basis so that they do not have to worry about the money incurred in purchase of data. To solve the problem of availability of study material students must be made aware about e-learning resources through online workshops and other activities.

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CONFLICT OF INTEREST

The author of the present manuscript declares that there is no conflict of interest.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1002/hbe2.290.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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