

Constraints in Online-Teaching of Agricultural Undergraduates in North-East Region of India during COVID-19 Pandemic

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ARTICLE INFO

Article history:

Received: 22 August, 2022

Revision: 20 September, 2022

Accepted: 24 September, 2022

Key words: Online teaching, constraints, COVID-19, agricultural education, North-East India

DOI: 10.56678/iahf-spl2022.17

ABSTRACT

The COVID-19 pandemic has forced educational institutes in India including Agricultural Universities to adopt online remote teaching. This sudden shift to online-teaching are was a big challenge. For the North East Region of India (NER), already constrained in terms of ICT infrastructure and higher education, the challenges were relatively bigger. The study was conducted in NER to study the constraints in teaching agricultural undergraduates. All the teachers of institutes in the region, offering undergraduate level degree course in Agriculture constituted the sampling frame. Online questionnaire was sent to all the teachers of which 75 responses were received, which formed the respondents of the study. A total of 22 constraint items were identified. Constraints items were categorized into four categories. Difficulties in conducting field and lab related practical class was rated the most important constraint. Teaching Facilitation constraints had the highest mean intensity score followed by Infrastructural constraints, Personal constraints and Technological Competency constraints. Capacity building on creation of e-teaching contents; training on online communication and facilitation skills; strengthening technical and administrative support system for online teaching; sharing of learning experiences of innovative e-teaching and hybrid teaching strategies amongst teachers; and development of topic specific appropriate strategies and e-teaching modules for conducting classes were recommended.

1. Introduction

The Coronavirus Disease of 2019 (COVID-19) which was first reported in December 2019 has shaken the whole world for a couple of years. In a span of few months the virus spread to many parts of the world which prompted World Health Organization (WHO) to declare the situation a pandemic on 11th March, 2020. COVID-19 and stringent measures adopted by Governments to curb its spread has caused havoc to lives and livelihoods affecting economy and functioning of health care system and many more sector. The education system is one of the highly affected sectors. Harnessing the opportunity of the advancement and penetration of internet and computer technology, many academic institutions including the agricultural universities have been introduced to a brand new

world of online learning and online remote teaching as main response to closure of educational institutions. In this time of uncertainty, e learning and other technical solutions will be the most feasible solution to compensate the potential loss on global education (Barman and Das, 2020).

Online teaching implies the use of internet and computer technology for enhancing teaching-learning process, more specifically in context of remote teaching. Online teaching and learning enable students to take part in teaching learning activities remotely from home and different locations. Hodges *et al.* (2020) used the term 'Emergency Remote Teaching' to describe the present context of online teaching as opposed to conventional online teaching. Many studies on higher education through online mode, especially

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in the developing and underdeveloped countries indicated the lack of readiness of the system for the same (Naik *et al.*, 2021; Adnan and Anwar, 2020; Coman *et al.*, 2020). However, these challenges are more intense in the remote North-East Region of India (NER).

In a pilot study of e-learning in higher agricultural education in North East India, Pandey *et al.* (2016) reported lack of calculated planning and vision, lack of support for pedagogical aspects of development and lack of training in technological developments as major constraints of e-learning. Lack of proper digital infrastructure in the educational institutions is a major constraint for online teaching. So the effectiveness of online learning in the midst of the pandemic is a matter of concern. The region being geographically constrained is less accessible and face a number of obstacles like lack of infrastructure, socio-political unrest etc. Kalita (2018) reported that internet has touched just 35% of the population of the eight northeastern states.

Challenges in providing education to agricultural undergraduates through online mode are specific in terms of the class strength, laboratory and field work related practical, collaborative learning among students etc. This study presents the constraints perceived by teachers in agricultural education institutes in NER and offer recommendations for improvement.

2. Materials and Method

All the institutes of NER offering Bachelor of Science in Agriculture {B.Sc. (Agri)} degree course formed the sampling frame of the study. The institutes are:

1. Assam Agricultural University, Jorhat
 - College of Agriculture, Jorhat
 - Biswanath College of Agriculture, Biswanath Chariali
 - Sarat Chandra Sinha College of Agriculture(SCSCA), Dhuburi
2. Central Agricultural University, Imphal
 - College of Agriculture, Iroishemba, Manipur
 - College of Agriculture, Pasighat, Arunachal Pradesh
 - College of Agriculture, Kyrdemkulai, Meghalaya
3. Nagaland University, Zunheboto
 - School of Agricultural Sciences and Rural Development (SASRD):
4. Tripura University, Agartala
 - College of Agriculture, Agartala
5. Private institutes
 - Apex Professional University, Arunachal Pradesh;

- Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Manipur;
- Arunachal University of Studies, Arunachal Pradesh etc.

Complete enumeration of the faculty members (regular or contractual) of the institutes was done. Contact details of the teachers were procured through institute websites and other key sources.

For studying the constraints in online teaching, an exhaustive list of all the constraints related to online teaching were identified from review of available literature. The items were then carefully scrutinized so that similar ideas were clubbed together and items irrelevant to the study context were removed yielding 18 constraint items. After consultation with selected faculty members of the CAU, Imphal another 4 items were incorporated. Thus the final list of the constraints consists of 22 items. The items were grouped into 4 categories as Infrastructural Constraints; Technological Competency Constraints; Teaching Facilitation Constraints and Personal Constraints.

The respondents were instructed to rate each constraints on the basis of their perceived severity on a five-point rating scale with response categories as very high, high, moderate, low and very low with a score of 5, 4, 3, 2 and 1 respectively. Mean score of each constraint was calculated and the ranks assigned for the statements. An online questionnaire (Google form) including the constraint scale was constructed and sent to the e-mail of the teachers. The questionnaire was emailed to a total of 252 addresses. To those whose whatsapp numbers were known, the questionnaire was sent via whatsapp as well with request to circulate it to their colleagues. Responses were received from 75 teachers within a duration of 30 days. The results presented are based on the response of these 75 teachers. The data collection was done during June-July 2021.

3. Results and Discussion

Profile of the respondents: Descriptive analysis of the profile of the respondents is presented in Table 1.

Table 1. Descriptive analysis of the profile of the respondents**(N=75)**

Sl. No.	Variables	Category	Frequency	Percentage
1	Age (In years)	Young (<35)	44	58.67
		Middle aged (35-50)	22	29.33
		Old (>50)	9	12.00
		Mean	39.77	
		Standard deviation	8.04	
		Range	30-63	
2	Gender	Male	50	66.67
		Female	25	33.33
3	Faculty rank	Assistant Professor/Equivalent Rank	35	46.67
		Associate Professor/Equivalent Rank	21	28.00
		Professor/Equivalent Rank	19	25.33
4	University	CAU, Imphal	44	58.67
		AAU, Jorhat	11	14.67
		Nagaland University	5	6.66
		Tripura University	10	13.33
		Others	5	6.66
5	Discipline	Natural Resource Management	15	20.00
		Plant Protection	9	12.00
		Crop Improvement	9	12.00
		Social Sciences	18	24.00
		Horticulture	16	21.33
		Basic Sciences	3	4.00
		Others	5	6.67
6	Overall teaching experience (in years)	Mean	8.21	
		Standard Deviation	7.13	
		Range	2 -31	
7	Online teaching experience (in months)	Mean	12.85	
		Standard Deviation	3.91	
		Range	2-17	

Majority of the teachers (58.67%) were young, 29.33 percent were middle aged and only 9.00 percent were aged above 50 years. Most of the responses were from the younger faculty members who were more at familiar with online questionnaires. The mean age of the respondents was only 39.77 years confirming the fact. Osika *et al.* (2009) also reported that older academic members tend to lack the knowledge or skills to use technology creating competency challenges for them. The male and female respondents were in the ratio of 2:1. About half of the respondents (46.67%) were of Assistant Professor or equivalent rank; while respondents with Associate Professor or equivalent rank; and Professor or equivalent rank constituted 28.00 percent and 25.33 percent respectively. More than half of the respondents (58.67 %) were from Central Agricultural University, Imphal followed Assam Agricultural University, Jorhat (14.67 %) and Tripura University (13.33 %). Broad discipline wise maximum representation was from Social Sciences (24.00 %); followed by Horticulture (21.33 %); Natural Resource

Management (20.00 %); Plant Protection (12.00 %) and Crop Improvement (12.00 %). The respondent had an average teaching experience of 8.21 years. Most of them had no online teaching experience prior to the pandemic.

Constraints in online teaching of agricultural undergraduates: The study identified 22 constraint items which teachers may face in online teaching. The constraints were classified into 4 categories as: Infrastructural constraints; Technological Competency constraints; Teaching Facilitation Constraints and Personal constraints. The constraints are listed and ranked in table 2 and table 3 according to the mean score of their severity expressed by the respondents.

Table 2. Constraints faced by the teachers in online teaching during COVID-19 pandemic
(n = 75)

Sl. No.	Constraint Items	Mean score	Rank
Infrastructural constraints			
1.	Inadequate ICT facilities (desktop/ laptop and other devices)	3.07	XI
2.	Poor internet connectivity and network	3.09	X
3.	Erratic power supply	3.03	XIII
4.	High cost of acquiring, installing, operating and maintaining ICT tools	3.13	VIII
Technological Competency constraints			
5.	Poor awareness and skill on software and apps used for online teaching	2.65	XX
6.	Lack of training and technical assistance for online teaching	2.97	XV
7.	Complexity in use of ICTs and resultant lack of confidence in operating	2.96	XVI
8.	Difficulty to organize, manage and keep track of e-learning resources, soft copies of assignments/ records, attendance etc.	2.64	XXI
9.	Lack of awareness of online teaching resources and perceived low credibility of the same.	3.01	XIV
Teaching Facilitation constraints			
10.	Limited interaction / difficulty in interaction with students during online sessions	2.95	XVII
11.	Difficulty to assess students' attention and understanding while sharing screens	3.27	III
12.	Difficulty in monitoring of quizzes and examinations	3.17	VII
13.	Difficulty in conducting laboratory related practical classes	3.52	II
14.	Difficulty in conducting field related practical classes	3.53	I
15.	Difficulty in assigning and execution of group assignments	3.21	V
16.	Dissociation of theoretical frameworks of courses on practical applications.	3.24	IV
Personal Constraints			
17.	Lack of time to explore and use different online teaching resources	2.91	XVII
18.	Physical stress like strain in eyes, headache etc. due to prolonged use of electronic devices	3.11	IX
19.	Psychological stress and anxiety induced by the pandemic which affects motivation to teach	3.19	VI
20.	Increasing domestic workload during work from home period due to lockdown	3.04	XII
21.	Non-cooperative family members during work from home period due to lockdown	2.45	XXII
22.	Inability to conduct classes according to scheduled time.	2.81	XIX

Table 3. Category wise score of the constraints (N=75)

Sl. No.	Constraint categories	Mean score	Rank
1	Infrastructural constraints	3.08	II
2	Technological Competency constraints	2.84	IV
3	Teaching Facilitation constraints	3.27	I
4	Personal constraints	2.91	III

From the above table it is found that Teaching Facilitation constraints was ranked the most intense constraints with a mean score of 3.27, followed by Infrastructural constraints (Mean =3.08), Personal constraints (Mean=2.91), Technological Competency constraints (Mean=2.84).

The description of the each competency category is presented below.

a. Teaching Facilitation constraints: A teacher acts as a facilitator by making learning easy, effective and exciting. This is achieved through use of various pedagogical methodologies teaching and learning. Teaching facilitation strategies for physical classroom and for remote online classroom may be very different. The role of a facilitator is important in online teaching (Berge, 1995). Without facilitation, teaching becomes less effective. Under teaching constraints, there are 7 constraint items are included of which 5 are the ranked the most intense constraints of the total 22.

Most of the respondents stated that difficulty to conduct field and laboratory related practical classes were the major constraints of online teaching. In B.Sc. (Agri) degree programme there are many disciplines where practical classes require field works like crop cultivation, sample (soil, plant, insects etc) collection, experiments, observations, interaction with stakeholders etc. Disciplines such as Plant Pathology, Biochemistry, Biotechnology, Soil Science etc. require laboratory related practical class. Most of these activities are difficult to be carried out in online remote mode especially that there is no tried and tested strategy to facilitate learning such type of subject matter. Students must apply the theoretical knowledge in practical work, which is challenging through online mode. This problem was also reported by Naik *et al.* (2021) and Mukhtar *et al.* (2020). Mishra *et al.*, (2020) suggested use of simulation techniques in laboratory practical.

In popular online conferencing platforms used for online teaching, the screen sharer has no scope to see the video of their audience. This reduces the effectiveness of teaching as teachers are unable to understand students' faces and moods, making it difficult to adjust the teaching style (Mishra *et al.*, 2020).

In any educational institution, academic evaluation of students is a very important. One of the most difficult components of administering online remote exams is ensuring that students are not aided by the internet or other resources during evaluation. Without streamlining a foolproof mechanism for evaluation, which would require certain interim changes, online monitoring of exams for undergraduate students will be a challenge.

With limited time allotted to each synchronous session, poor network connection and large class strength,

interactivity each and every one attending the session is reduced to a great extent. It creates communication gap and online sessions become teacher centric. Adnan and Anwar (2020); Jena (2020), Fatonia *et al.* (2020); Coman *et al.* (2020) and Hasan and Khan (2020) reported that lack of proper interaction was a major constraints in online teaching. Group activities and collaboration among students reinforce learning and generate new ideas. Many teachers expressed that group discussions and executions of group assignments cannot be conducted effectively through online mode. Fatonia *et al.* (2020) mentioned difficulty to conduct team projects as a source of dissatisfaction towards online teaching.

b. Infrastructure constraints: The prerequisite for online as well as hybrid teaching is infrastructure in the form of hardware and software. Online as well as hybrid teaching requires a combination of various ICT tools. The cost associated with acquiring, installing, operating and maintaining these ICT tools like desktop and laptop, projector, tablets, Interactive white board, scanner, microphone, internet facilities usually cost the educational institution highly. During work from home sessions, the expenses for purchase of devices and data connections are borne by the teachers themselves. Even when teaching remote from institute, some institutes does not have provision for all the necessary tools and equipments and teachers reported using their own devices and data sources. Almaiah *et al.* (2020) mentioned financial support as one of the important component for success of online teaching. Dhawan (2020) also reported that unequal distribution of ICT infrastructure; technology cost & obsolescence were the major challenges towards online learning. Insufficient data provision was highlighted by Fatonia *et al.* (2020).

Another crucial element for online teaching is Internet connectivity which both teachers and students face due to poor network connection. The North-eastern region of India face more problems due to poor network connections as internet penetration is low in this region compared to other regions of India. Poor internet connectivity was cited as a major obstacle for conducting online sessions by Naik *et al.* (2021); Adnan and Anwar (2020); Jena (2020); Fatonia *et al.* (2020) Hasan and Khan (2020), etc.

Still, the most indispensable element is power supply. During most part of the pandemic students were located in their hometown, some in faraway remote places where power supply tends to be erratic. Overall, in most part of NER, erratic power supply is a common phenomenon. This hampers operation/ charging of devices and causes fluctuation in network as well disturbing online classes. Only 29.33% of all teacher respondents had access to an uninterrupted power supply. Mishra *et al.* (2020) also

mentioned uninterrupted electricity connection as one constraint.

c. Personal constraints: Personal constraints are the constraints that arise from one's own feelings or from certain associative relationships. Under personal constraints 6 constraints items are included.

The pandemic has had an impact on students' as well as teachers' mental health. Teachers had to endure mental and physical stress during lockdown as a result of having to adjust to conduct online lectures (Besser *et al.*, 2020 and Dhawan, 2020) as well as lack of socialization which affects the motivation to teach. Physical stress like strain in eyes, headache etc. due to prolonged use of devices was also reported by the teacher respondents. Excessive use of electronic device is reported to cause a wide range of eye problems (Bhattacharya *et al.*, 2020). During work from home period due to lockdown, teachers, especially women tend to be overburdened with household chores and kids. Increasing domestic workload due to absence of domestic help, increased responsibility for children due to closing of school and online classes affected productivity and efficiency of work for some teachers. This constraint intensifies if there is lack of understanding and cooperation from family members. This also leaves the teachers with less time and energy to explore and use different online teaching resources and tools which they are still not well accustomed to. Joshi *et al.* (2020) reported that external distraction and family interruption affects online teaching during work from home period.

d. Technological Competency constraints: A technologically competent teacher is well aware technological tools and equipments (both hardware and software) needed for online teaching as well as how to use and manipulate them efficiently. Basic technological competency is pre-requisite for online teaching.

Not all the teachers are equally competent and they face different challenges during online teaching. Gautam (2020) reported that lack of teacher's training is a major disadvantage of online teaching. Naik *et al.* (2021) suggested training of teacher to use ICT. Coman *et al.* (2020) reported lack of technical skills and improper teaching style for online environment as important constraints.

There are different platforms for online teaching. Teachers are not well aware of the software and the associated features. They face problems in installation and operation. Lack of knowledge on virtual platform obstructs online learning (Jena, 2020). Technical difficulties and lack of confidence in online teaching was also reported by Dhawan (2020).

Another constraint reported was difficulty in organization and tracking of records, assignments submitted by students, maintenance of attendance etc through online mode. Some teachers go through the tedious process of downloading, printing, checking/evaluation of the students' work. With the use of right technology and management these tasks can be made much simpler and less time-consuming. But many teachers are not aware of the right software and the uses.

Recommendations for improvement of online teaching:

Some recommendations for improving online teaching are suggested hereunder based on the results of the study and review of literatures done for the study.

- a. Difficulties in conducting **field and lab related practical class** was rated the most important constraint. Some colleges have reported collaborating with NARS (National Agricultural Research System) institutes (KVKs, SAUs, ICAR institutes etc) near the location/resident of the student. The manpower and infrastructure of the institute is made available to teach the student. Financial implications for the same may be worked out by the collaborating institutions. Mishra *et al.* (2020) suggested use of simulation approaches in laboratory practical.
- b. Difficulty to assess students understanding during online sessions; and difficulty to carry out group assignments is other important constraints identified. Workshops on effective facilitation skills of interpersonal as well as intra-group **communication** for online synchronous as well as asynchronous sessions using various communication methods may be organized. Such workshops may also explore available software and efficient use of the features.
- c. The challenges related to **evaluation and examinations** are also emphasized in the findings. Modifications and flexibility in evaluation system to suit the e-learning context is recommended. Some strategies adopted by colleges include evaluation with objective type questions. Providing more assignment on experiential works and application exercises which can be completed easily at home setting. Need for constructive feedback on assignments and practical records is emphasized by Bao (2020). For practical examinations, the same strategy of collaborating with NARS institute may be employed.
- d. Requirement for **assistance on technical matters** related to hardware, software and internet connectivity have increased and hence organizational support

system regarding this may be strengthened. Elumalai *et al.* (2020) and Naik *et al.* (2020) also reported need for administrative support, social support and technological support.

- e. Joshi *et al.* (2020) highlighted the need to have a dedicated department committed to developing the **institution's technical infrastructure** in order to incorporate technology-driven education in real or virtual environments. Training of all stakeholders on LMSs (Learning Management Systems) is essential.
- f. Successful online learning is the result of careful **instructional design and planning**, as well as the use of a systematic design and development process. This careful design process is absent in online teaching in the current pandemic situation. There should be some flexibility for course policies, submission of assignments, institutional policies. (Hodges *et al.*, 2020).
- g. Training on creation of asynchronous learning resources like lecture videos, multi-media resources, interactive teaching modules using storyboard is required. Naik *et al.* (2020) suggested interactive sessions, animations or game to be included in online course curriculum to avoid boredom. Rhim and Han (2020) recommended use of flipped classroom where students are provided with pre-recorded lecture before the class so that students can connect their previous experiences with the new environment.
- h. Rhim and Han (2020) recommended creation of **learning community** as synchronous and asynchronous discussion can be beneficial because students learn not only from teachers but from peer students, or by teaching others. Teacher should recognise and facilitate the learning community and can create a new one.
- i. Bao (2020) advised teachers to prepare **emergency plan for unforeseen issues** which include informing students before the class, preparation of plan B or plan C to avoid some problems like computer server down, shut down of online education platform due to overload etc. Another was that teachers should divide the content into several smaller module of 20-25 min duration to ensure a clear knowledge structure in the curriculum.
- j. All agricultural education institutes and teachers have resorted to some form of Innovative e-teaching and

hybrid strategies for conduction theory and practical classes. Such strategies and experiences need to be documented and shared by Agricultural Universities or ICAR. Based on the learning experiences, topic specific appropriate strategies and e-teaching modules for conducting classes may be developed.

4. Conclusion

The adoption of online teaching was a contingent response to the pandemic induced lockdown. The system and the teachers were not prepared for the sudden change. There were no proper infrastructure; teachers and students did not possess sufficient skill and experience to handle online classes and almost all online teaching were learning through trial and error for both parties. The study identified and assessed the constraints faced by the teachers of NER in imparting B.Sc (Agri) education through online mode. The study also made a humble attempt to suggest some recommendations for improvement of online teaching. It is of general opinion that blended or hybrid teaching will be the new normal in teaching in the future. In this regard, the findings of the study will be valuable feeds for practitioners as well as policy makers for making online teaching more effective.

5. References

- Adnan M, Anwar K (2020). Online learning amid the COVID-19 PANDEMIC: Students' perspectives. Online Submission 2(1): 45-51.
- Almaiah MA, Al-Khasawneh A, AlthunibaA (2020). Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. Educ. Info. Technl. <https://doi.org/10.1007/s10639-020-10219-y>
- Bao W (2020). COVID-19 and online teaching in higher education: A case study of Peking University Human behavior and emerging Technologies 2(2):113-115.
- Barman A, Das K (2020). Pre-Print: Re-casting e-learning and e-education during COVID-19 Pandemic-A study on the e-learning initiatives with special reference to North-East India. <https://www.researchgate.net/publication/341384419> Accessed 15 May, 2021.
- Berge ZL (1995). The role of the online instructor/facilitator. Educational technology 35(1): 22-30.
- Besser A, Lotem S, Zeigler-Hill V (2020). Psychological stress and vocal symptoms among university professors in Israel: Implications of the shift to online synchronous teaching during the COVID-19 pandemic. J. Voice Official J. Voice Foundat. DOI: 10.1016/j.jvoice.2020. 05.028

- Bhattacharya S, Saleem, SM, Singh A (2020). Digital eye strain in the era of COVID-19 pandemic: An emerging public health threat. *Indian J. Ophthalmol.*
https://doi.org/10.4103/ijo.IJO_1782_20
- Coman C, Tiru LG, Meseşan-Schmitz L, Stanciu C, Bularca MC (2020). Online teaching and learning in higher education during the coronavirus pandemic: students' perspective. *Sustainability* 12(24), 10367.
- Dhawan S (2020). Online learning: A panacea in the time of COVID-19 crisis. *J. Educ. Technol. Syst.* 49(1):5-22.
- Elumalai KV, Sankar JP, Kalaichelvi R, John JA, Menon N, Alqahtani MSM, Abumelha MA (2021). Factors affecting the quality of E-Learning during the COVID-19 pandemic from the perspective of higher education students. *J. Inf. Technol. Educ. Res.* 19:731-753.
- Fathaigh M (2002). e-Learning and Access: Some Issues and Implications. UAC E Conference, University of Bath.
- Fatonia NA, Nurkhayatic E, Nurdiawatid E, Fidziahe GP, Adhag S, Irawanh AP, Azizik E (2020). University students' online learning system during Covid-19 pandemic: Advantages, constraints and solutions. *Syst. Rev. Pharm.*, 11(7):570-576.
- Gautam P (2020). Advantages and disadvantages of online learning.
<https://elearningindustry.com/advantages-and-disadvantages-online-learning> Accessed 12 May, 2021.
- Hasan N, Khan NH (2020). Online teaching-learning during COVID-19 pandemic: Students' perspective. *T Onl J Dist Edu and e-Lrng.* 8(4): 202-213.
- Hodges CB, Moore S, Lockee BB, Trust T, Bond MA (2020). The difference between emergency remote teaching and online learning. <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>. Accessed 23 July 2021
- Jena PK (2020). Online learning during lockdown period for COVID-19 in India. *Intl J Mult Edu Resh*, 9.
- Joshi A, Vinay M, Bhaskar P (2020). Impact of coronavirus pandemic on the Indian education sector: Perspectives of teachers on online teaching and assessments. *Interactive Technology and Smart Education.*
- Kalita, P (2018) Northeast states lag behind in internet, mobile connectivity.
http://timesofindia.indiatimes.com/articleshow/67168080.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst, . Times of India, Guwahati, December 19, 2018.
- Mishra L, Gupta T, Shree A (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *Intl J. Edu, Resh Open* 1, 100012.
- Mukhtar K, Javed K, Arooj M, Sethi A (2020). Advantages, limitations and recommendations for online learning during COVID-19 pandemic era. *Pak. J. Med. Sc.* DOI: 10.12669/pjms.36.COVID19-S4.2785.
- Naik GL, Deshpande M, Shivananda DC, Ajey CP, Manjunath Patel GC (2021). Online teaching and learning of higher education in India during COVID-19 emergency lockdown. *Pedag Resh*, 6(1)
- Osika E, Johnson R, Butea R (2009). Factors influencing faculty use of technology in online instruction: A case study. *Onl. J. Dist. Learn. Adm.* 12(1).
- Pandey D K, De HK, Upadhayay AD (2016). Usage of ICAR e-learning portal among students of North East India: A pilot study. *Ind. J. Ext. Edu.* 52 (3, 4):69-72.
- Rhim HC, Han H (2020). Teaching online: foundational concepts of online learning and practical guidelines. *Korean J. Med. Edu.* 32(3), 175.