Effect of pandemic based online education on teaching and learning system

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ABSTRACT

Coronavirus outbreak mediated pandemic impacted most of the sectors globally. This includes the academic world that consists of millions of enrolled learners and active teachers who previously had regular classes in their institutions, and due to the pandemic, got stuck at the home. To continue the education process, the online class was introduced in most of the countries, including India. In this mode, both teaching and learning happen through electronic devices which are relatively new to the entire teaching-learning community. This study aimed to understand how online classes had fared for the teachers and students in India. Besides, it tried to understand the users' experience and the unique set of challenges that this mode of education brings.

Four separate questionnaires were created for school students, school teachers, college students, and college professors. The questions inquired about various aspects of online classes such as setting up online education at home, knowledge transfer, comfort, evaluation, and future aspects. The questionnaires were circulated electronically as google forms. The responses were received from the teachers (school teachers and college professors considering all courses) and learners (school and college students considering all courses) of various educational institutions across the country. The data was compiled and the results were discussed in two ways, firstly, the perspectives of teaching versus the learning group and secondly, school versus college groups on online versus regular classes. Though online training/distance education is practiced for a long time, the research on the mentioned aspects was limited. This study is the first of its kind which reflects the merits and demerits of the new-normal online education from home in the compiled voice of teachers and learners group in India. The study addresses the participant's compliments and grievances of online education compared to regular classes. This further enlightens how to improve the technologies to make them use more efficiently. Besides, this study gives a proper framework to modify or create educational policies, laws, and schemes to obtain equal access to resources for all.

1. Introduction

An uncanny suspect called SARS-CoV-2 had caused a serious venture of time from its origin to the current conditions all over the world. The COVID-19 ultimately jostled our day-to-day lifestyle and led to a new custom of life within the curbs to cease the spread of this virus as it is seriously contagious. According to UNESCO, by the end of April 2020, 186 countries have implemented nationwide closures, affecting about 73.3 % of the total enrolled learners (Education: From disruption to recovery, 2020). As a result, the complete lockdown has led the educational institutions to resort to online methods in quick action to ensure continuity of learning in students as traditional face-to-face learning was not possible in this unprecedented situation.

In developing countries like India, traditional learning methods were widely accepted before the emergence and spreading of COVID 19. However, the closure of institutes and pressure to complete the prescribed syllabus in a stipulated time frame in line with the academic calendar forced the educational institutions to abandon their concerns and compelled them to adopt emergency remote education. The central government of India on March 16, 2020, announced the closure of all the educational institutions including schools, colleges, and universities as the number of positive cases of coronavirus in India has increased to 114, to control the spread of coronavirus infection. The center has also sent a letter to all Chief Secretaries to promote online education to compensate for the closure of the educational institutions and in favour of students in continuing the education. Therefore, after two to three

weeks, some of the educational institutions have started online classes, and within May 30, almost all educational institutions in the country commenced online classes (Mishra et al., 2020; MHRD, 2020).

It was for the first time in India online classes have been conducted on this massive scale. The commencement of online classes led to various difficulties for both teaching and learning communities, though, the internet is a major technological advancement reshaping society and universities worldwide (Volery and Lord, 2000). The online learning environment varies profoundly from the traditional classroom situation when it comes to learner's motivation, satisfaction, and interaction, as stated in a study in which 385 college students of various disciplines in Nepal were asked about their opinions regarding online classes implemented during COVID-19 lockdown (Aditya and Jha, 2020). This fact highlights the importance of assessing learner's and teacher's perspectives on online classes, a vital one. Worldwide, a few studies have been carried out in similar aspects which were listed in **Table S1** in the supplementary information. However, in India, there is no complete study covering the entire teaching and learning groups ranging from lower to higher education system on these much-needed features.

Having understood the importance of the above discussions, the objective of this study is to assess the teacher's and learner's outlook towards online teaching. This study analyzed the survey responses gathered from the participants ranging from school students to college students and school teachers to professors covering the entire focused classroom community. It is expected that the findings of this study will be useful in i) improving the current scenario of preparation, comfort, knowledge transfer, and evaluation pattern ii) enlighten the teaching and learning community to approach and get the best out of the online education and iii) suggest valid points to government and policymakers to update the current rules or frame new rules in lower and higher education.

2. Methodology

The study aimed to identify the influence and impact of online classes on students and teachers alike, thus has the following tasks as shown in **Figure** S1; i) preparation of survey questionnaires ii) data collection and iii) data interpretation.

2.1. Preparation of survey questionnaires

Totally, four sets of questions were prepared to circulate among the targeted groups and participants could respond to them. The questionnaire would focus on various aspects of online learning and the responses would give the required data for the study. An initial set of questions was created seeking the respondents' opinions on various aspects of the online learning medium. After careful discussion and deliberations, we decided to focus on four major aspects. These included setting up of online classes, knowledge transfer, comfort in online classes, evaluation, and future aspects. The questions were rewritten and reformatted to fit our aim and get the best possible answers. Four separate questionnaires were prepared to focus on four important groups: college students, college professors, school students, and school teachers. Within the four chosen aspects, questions were modified or new questions were added to fit each group. Most of the questions were multiple choice type questions and respondents were asked to choose the most appropriate option. Some were simple yes/no questions while others provided the respondents the option to select multiple answers. There was also the option to give the respondents' own opinions.

A set of questions were also added in the beginning to assess preliminary information such as demographics, type of institute, type of course, etc. with slight modifications in each separate questionnaire as deemed appropriate. All the questions were tabulated and four separate Google Forms were created. Not including the questions on preliminary information, there were 20, 20, 25, and 18 questions in the questionnaire for school teachers, college professors, college students, and school

students respectively.

2.2. Data collection and analysis

After the preparation of questionnaires, the Google Forms were circulated among the target groups in different states of the country which collected responses dated from 12th June to 20th August. This was done through email, WhatsApp, Telegram, and other messaging and social media platforms. All the responses were collected in an excel sheet and visualized as charts wherever applicable.

2.3. Data interpretation

The responses were analyzed as two groups, firstly the learners that include students from schools and colleges and secondly the teacher's group consisting of school teachers and professors. The results of all the questions were studied and various opinions and problems raised by the respondents were compiled, compared, and interpreted. The interpretation includes the underlining cause of the obtained result, the effects it brings up, and the future predictions and recommendations. The results were compared with existing literature and well discussed.

3. Results and discussion

The observations and discussions start from students' – the learners followed by the teachers' view, and the order is from lower to higher education system. These results were then expressed in the form of a discussion focusing on the major aspects of i) preliminary information ii) Method of Teaching and setting up online classes at home iii) level of comfort iv) attentiveness and knowledge transfer) evaluation methods in online classes and vi) future aspects.

3.1. Learners from lower education– the school students' view

3.1.1. Preliminary information

The questionnaire for school students was circulated across various schools in India, comprising students from classes in the range of 1–12 standards. Primary education includes classes 1 to class 8, for the age group 6–14 years. It can be subdivided into two, lower primary (Classes 1–4) and upper primary (Classes 5–8) classes. The remaining part of schooling falls under secondary education, which comprises of students of age group 14−18. Classes 9 and 10 constitute secondary school (high school) and classes 11, 12 forms higher secondary/ senior secondary school. Schools in India may be affiliated under any of the three national boards – CBSE (Central Board of Secondary Education), CISCE (Council for the Indian School Certificate Examinations), or NIOS (National Institute of Open Schooling) – or under the state board of the respective state in which it is located. These boards decide the curriculum that the school is supposed to follow and conduct standardized nationwide examinations called 'Board exams' for classes 10 and 12 (Wikipedia, 2021).

Among the total, only 2.6 % of the student belonged to places which were hit severely by COVID-19. About 63 % were from 1st to 3rd standards, 29 % from 6th to 10th, 5% represented higher secondary (+1,+2/PUC), and the rest of them were from 4th and 5thstandards. Respondents belonged to a wide variety of boards of education such as boards of their respective states (77 %), CBSE (21 %), a few (2%) from CISCE/ICSE. It is seen that 9 out of 10 students had online classes. This fact shows that almost all institutions switched to online methods at least temporarily.

3.1.2. Method of teaching and setting up online classes at home

School students were asked a question with multiple choices about the methods by which they are being taught. The responses are shown in Fig. 1. The common methods of teaching included recorded (70 %) or live online lectures (20 %) using television and various applications such
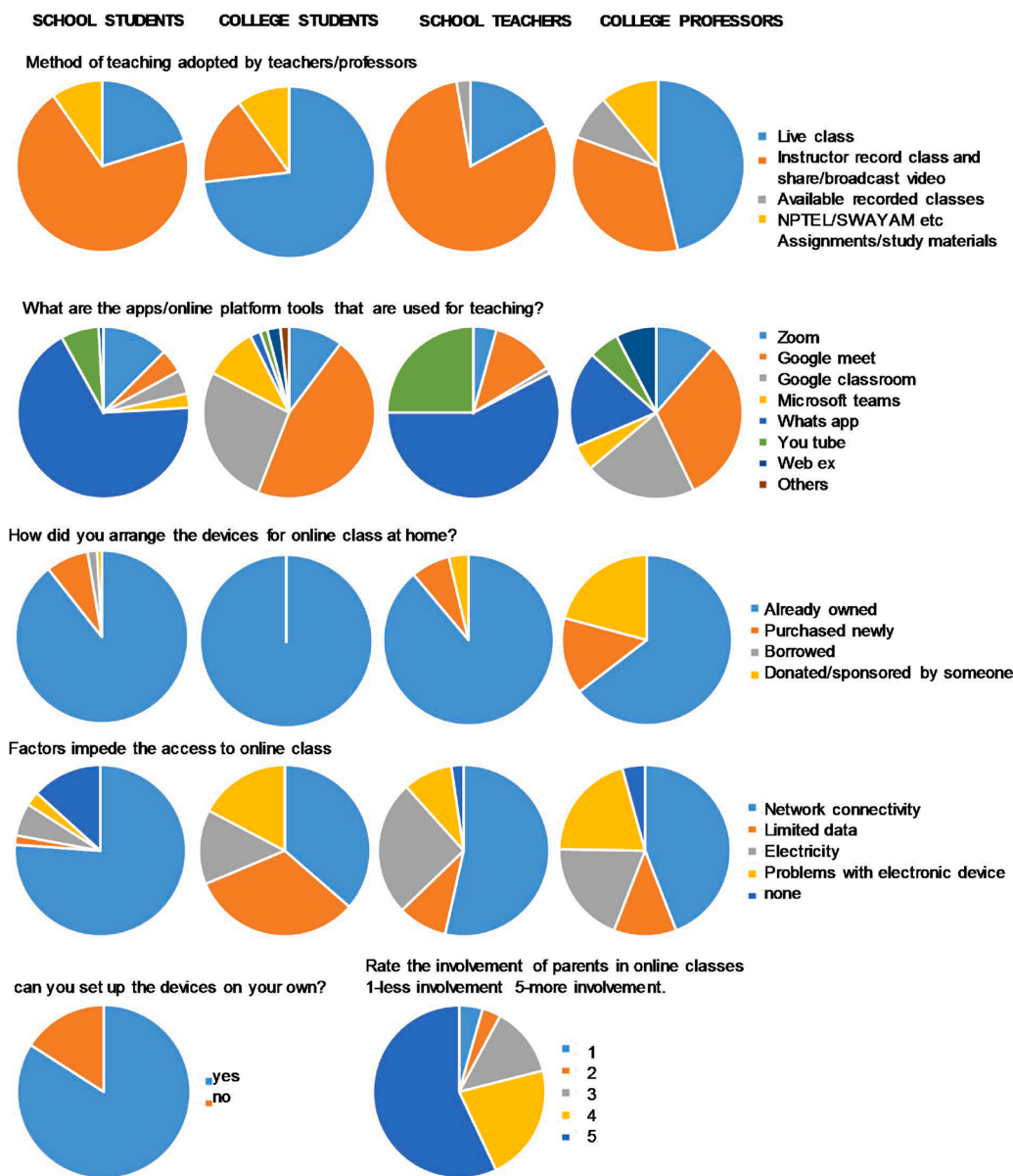
Fig. 1. Method of teaching and setting up online classes at home.

as Google Meet, Zoom, WhatsApp, YouTube, Microsoft teams, WebEx. Whats app was the most preferred platform (68 %) as they are easy to handle and don't require any technical skills for operating, especially by school students. Assignments and homework (10 %)were also used to supplement the lectures. A significant number of school students made use of either recorded classes or live classes conducted by their teachers.

When students were asked how they arranged the electronic devices required for online classes, the responses show that a majority (89.4.3 %) already had the required devices (television, smartphone, laptop, etc.) at their home, 8% purchased new devices while 1.8 % borrowed from other people. Scarce respondents had them donated by their school or by someone else. It is possible that in households where more than one student needed to attend online classes, there weren't enough devices. According to a report (Education: From disruption to recovery, 2020) given from a global perspective, almost 826 million students kept out of classrooms don't have a household computer and 706 million have no internet at home. This will alienate economically disadvantaged students especially in rural areas of our country who don't have access to the technology.

There might have been students who didn't have or used such

devices until now. Concerning the management of electronic devices, 84.1 % said that they could operate on their own. In this regard, students were asked to rate the involvement of their parents in their online classes and studies on a 1–5 Likert scale, where 1 marked the least and 5 marked the highest involvement. About 33 % and 27 % chose 5 and 4 respectively which suggests that more than half of students' parents were involved in their online mode of education. Attending classes from home seemed to increase parents' participation in their children's classes.

Students were asked what they thought were the causes of occasional impedance to their online classes, in such a way that they could choose multiple problems. Network connectivity issues (76 %)were the most opted choice. Students in rural areas particularly might have been facing issues of bad network coverage. There have even been reports of students in Uttarakhand being forced to trek for kilometers to get a proper signal to attend online classes (Roy, 2020). Optic fiber and broadband networks are often only found in and around urban areas. Interrupted electricity has also badly affected some of the respondents (6%). Interestingly, 13 % of the students didn't have any difficulties. The graphical representation of the percentage of students corresponding to each option for these questions is shown in Fig. 1.

3.1.3. Level of comfort in online classes

The level of comfort was assessed based on the tightness of the schedule, refreshment intervals, physical pains, and mental stress (see Fig. 2). As shown in Fig. 2, only13 % of the students weren't getting enough time to refresh in between classes. Overall, the majority of students had a relaxed schedule with fewer amounts of class hours compared to regular classes, giving them the advantage of being able to keep up with the courses taught even though the learning environment might not have been ideal. Moreover, ~18 % did report having some physical and mental discomforts which include severe headache, strain, and irritation in the eyes, lack of concentration, etc. More time in front of screens could be a cause of these physical stresses. A majority (94 %) found regular classes more comfortable than online classes. However, there were a few students (4%) who reported for the reverse case.

Moreover, few questions were framed to assess the time spent on electronic screens due to online classes. The responses revealed that students from classes 1–3 ha d less than an hour of class per day. About 31.9 % of students had 1−2 h, out of which 3 out of 5 students were from 9−10. A quarter of them had classes for 3−4 h, and only a few had 5−6 h of classes per day.

It is also observed that the numbers of classes are positively correlated with the ascending order of the class that the student belonged to. Among, nearly half of the students (48.7 %) were taught 1 subject per day and 46.9 % had 2–3 subjects. This showed that the duration of online classes and subjects taught per day was found to be very less than regular classes on average. This could be the result of a gradual shift to online classes. However, the amount of screen time spent by students especially in primary classes had led to much discussion about their perceived demerits. Recently, Union HRD released guidelines called "pragyata" limiting screen time in school students' online classes. According to this, the pre-primary student should only have a 30-min session, at most. Students in classes 1–8 could have 2 sessions of 30−45 min each and students in 9–12 could have 4 such sessions (HRD Ministry Launches "Pragyata" with Digital Education Guidelines, Screen-Time and Mental Health Tips for Children, 2020). For the question about access to the necessary textbooks required for studies, 9 out 10 of students reported that they had. But among those who didn't have

access to these, 52 % said this negatively affected their studies.

3.1.4. Attentiveness and knowledge transfer

Lack of direct interaction between students and teachers remains one of the biggest challenges that the online mode of education faces. "Students don't get to see the professor or class members face to face" is one of the main concerns raised when asked about the negative experiences of online classes in a case study involving 41 undergraduate students at a four-year mid-western (US) college (El Mansour and Mupinga, 2007). This is confirmed from the observations for a question in this survey, where 92.1 % of students believed that direct student-teacher interaction is essential for proper learning when asked about it (Fig. 3). It has been shown that inadequate individual attention and the delay in response from teachers might also be contributing factors to negative experiences encountered by students in online classes (El Mansour and Mupinga, 2007).

Another concern regarding online classes which was addressed in the survey was the attentiveness of students. This question was aimed at identifying the level of participation and focus of students during an online class. Nearly 3 quarters (73.5 %) of the students responded to being more attentive in online classes compared to regular classes. This is in contrast to our previous observation where the majority of the students reported they were less comfortable in online classes. This survey was conducted during the beginning of the online class era and parents might have been more concerned about the new form of classes. Also, parents at the time would have been working from home. Hence, they could direct more attention to their children and ensure their participation to the full extent. This is corroborated by our previous observation where the majority of students reported active participation from their parents in the learning process. Approximately, 8.8 % of students chose the option "almost the same".

The assessment of knowledge transfer was evaluated in 2 ways comparing online classes with regular classes. This includes i) clarification of doubts and iii) difficulty faced with different subjects. About 94 %of students reported that regular classes are better in terms of the extent to which they can clarify their doubts. Though the teaching methods and apps that were opted for many have sufficient options to
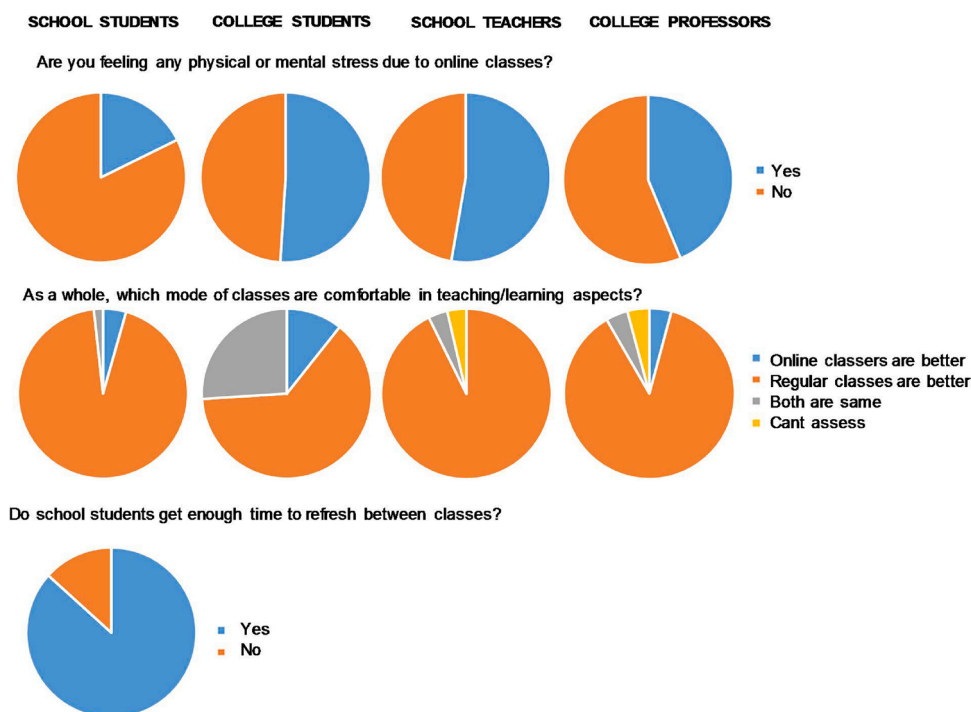

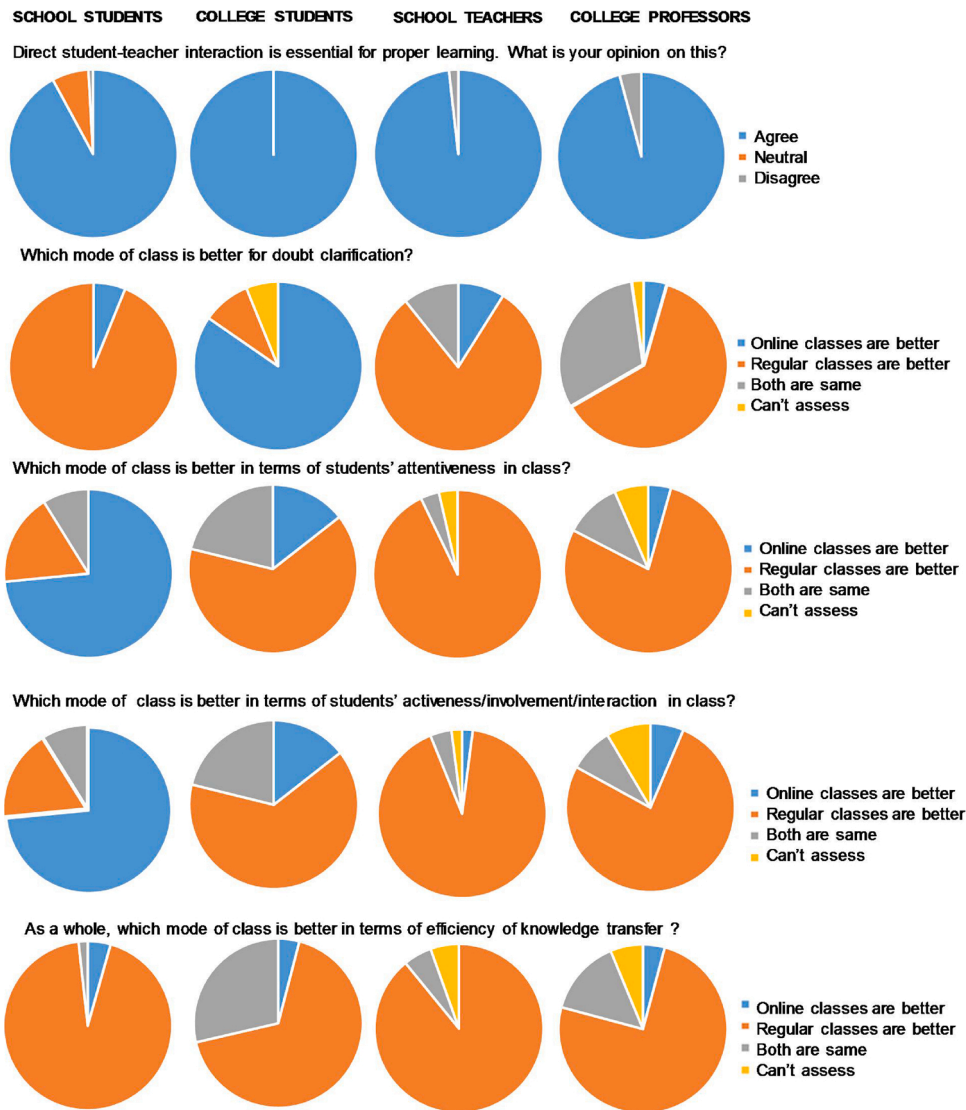**Fig. 2.** Level of comfort in online classes.

Fig. 3. Attentiveness and knowledge transfer.

communicate with teachers and other students to clarify their doubts, the purpose is not served when it comes to effective communication during online classes. This suggests that more discussions should be incorporated along with online classes by using chat rooms or other platforms and encourage more participation from students. But still, for a few students (6.1 %), online classes were better. Besides, about 73.5 % of students said that the online class has made some of the subjects more difficult than it is in a regular class. Mathematics and language subjects
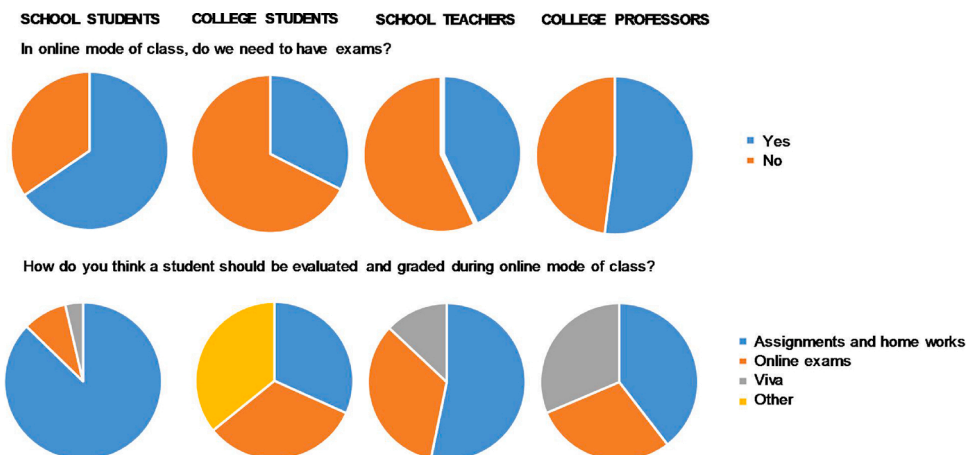

Fig. 4. Evaluation in Online Education.

are the most opted among many.

Most of the school students were highly accustomed to traditional classes and might not have thought about virtual classes replacing their regular classes. Hence, we can conclude that presently, online classes are not up to the standard of regular classes in learning aspects according to students.

3.1.5. Evaluation

It was found that about 65 % of the students agreed with the idea of conducting exams under these circumstances. The questions on evaluation and gradation were framed to have multiple options, which include assessment through online exams, assignments and homework, and viva voce. Most of the students (87 %) chose evaluation based on assignments and homework, as shown in Fig. 4. This was the most feasible solution to being evaluated as they are not familiar or comfortable with online exams. Evaluation based on viva voce was the least chosen one (4%), which may be due to the associated difficulty in preparation to face it for Indian students. Although the assessment of students has been carried out through different modes, it is a daunting process, as the students cannot be monitored during the evaluation in case of any malpractices. Moreover, the process is not fair to those who have to deal with problems like internet connectivity and electricity issues, as discussed in an article that explores the adverse effects of COVID – 19 on the education and mental health of students and faculty (Sahu, 2020).

3.1.6. Future aspects

Students will have become more familiar with many online resources during this period, hence opening up the possibility for more classes being held online in the future. If so, the students would encounter fewer

difficulties, as they are already familiar with this mode of education. But their continued use in the future returned split opinions. About 9 out of 10 were neutral or disagreed about using such resources. Further, 95 % preferred learning from a school than being home-schooled (Fig. 5). This might be due to the drawbacks of the online education system such as connectivity issues, technical difficulties, less social interaction, etc., despite its various advantages, like convenience and cost efficiency (Kumar, 2010). Resolving those inconveniences can open up a plethora of options for the school students to choose from regarding their education.

3.2. Learners from higher education–The college students' view

3.2.1. Preliminary information

Institutions of higher education were found to utilize alternative means of learning effectively in this unprecedented situation shifting away from the traditional means. The questionnaire to evaluate the perspectives of college students was prepared and circulated among college students about online classes. This includes all students who have completed higher secondary education and are pursuing under-graduate, postgraduate, or pH.D. courses. A total of 313 responses were received from students of various institutes across the country. Responses were received from students of all types of institutes, including autonomous, private, and government-controlled. According to the respondents, 95 % had some form of online classes during the lockdown period.

3.2.2. Method of teaching and setting up online classes at home

Live video classes were the most popular means of teaching (73.1 %). Recorded lectures were also used (16.8 %) along with assignments,
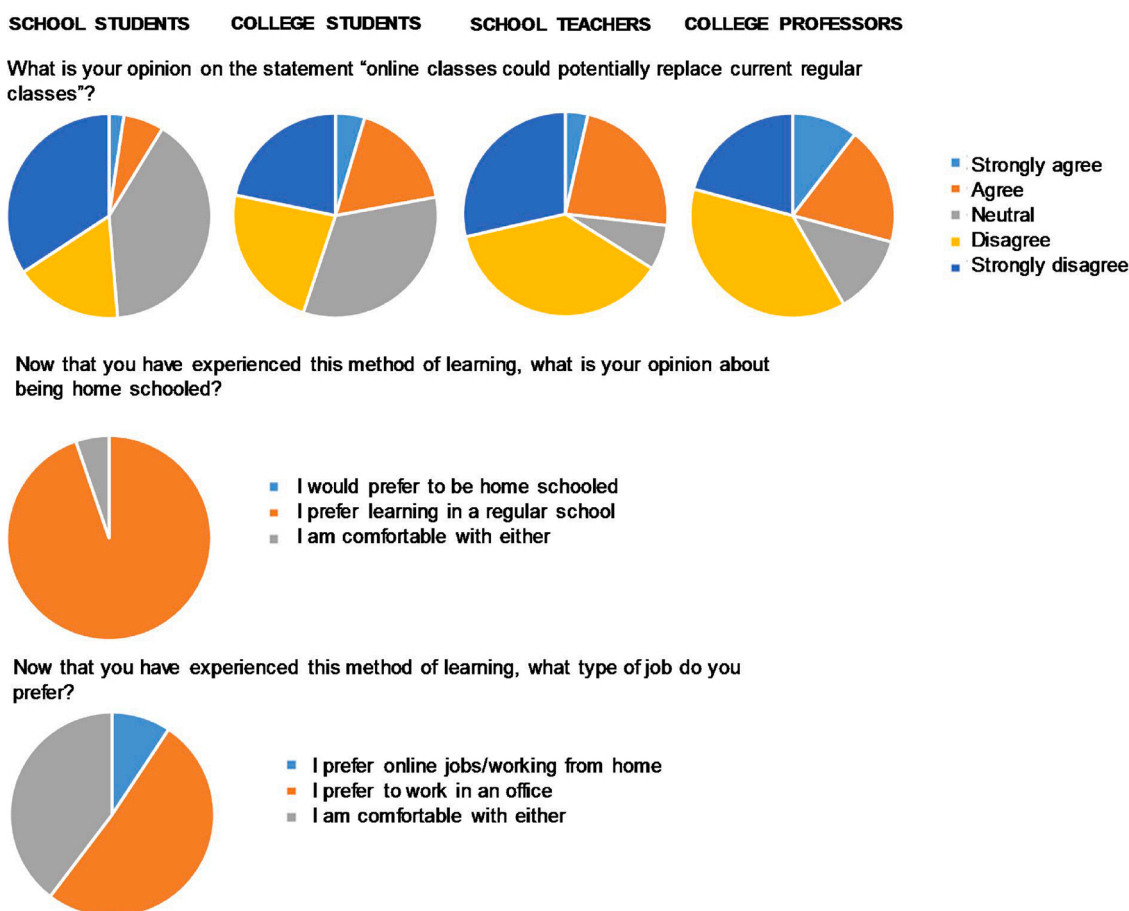

Fig. 5. Future perspectives on the online classes.

notes, and homework to supplement their studies (see Fig. 1). Alternatively, many college students reported that all of the above methods were used. The online classes were arranged using the online platforms of Google Meet, and Google classroom majorly, and Zoom and Microsoft teams, minor which supported live lectures. This preference for synchronous online classes might have been attributed to the fact that it resembles regular face-to-face classes more which is a must in higher education (Hrastinski, 2008). Asynchronous learning, wherein recorded lectures are used might not be particularly effective as students feel less oversight and less concerned about their responsibility to study, especially during this period. Live classes allow more real-time interaction, instant feedback making online learning more dynamic.

3.2.3. Level of comfort in online classes

When the college students were asked about their learning environment at home, only 1 out of 10 students thought it was better than in the institute. A majority (63 %) reported the situation was not comfortable, and the remaining students felt the conditions were identical. When students were asked to identify the significant challenges faced in accessing online classes, lack of individual attention and socialization, poor internet connectivity (affecting 36.3 %), technical issues (17.2 %), limited data (32.2 %), and lack of practical sessions, as shown in Fig. 1. All these problems were anticipated, as previously published articles have suggested that the above-mentioned issues could be considered as disadvantages of online classes (Lashgari et al., 2011). Earlier studies report that students feel a lack of community, technical problems, and difficulties in understanding instructional goals are the major barriers to online learning (Song et al., 2004). There are a large number of households without a computer or a smartphone and no internet connection, particularly in rural areas of our country. Ensuring access to online learning is a major challenge that lies ahead of the educational system.

3.2.4. Attentiveness and knowledge transfer

When asked if teaching is as efficient as before online classes or whether there is sufficient knowledge transfer from professors to college students, 2 out of 3 students reported it was not so. There are only 4% of students who believed online classes are better, with 28.6 % stating it is the same as before. About 64.4 % believed that interaction with teachers was less in online classes and 14.4 % said there was more interaction, and the remaining reported not feeling much of a difference. Similar results were drawn up from previous studies, according to which college students had a feeling lost in cyberspace due to lack of personal student-teacher relationship and being unable to verbalize their thoughts and let others hear their ideas (El Mansour and Mupinga, 2007).

Almost 85 % of the students said their doubts and problems were rectified by their institute out of which 47 % had their problems readily solved either by their teacher or institute. The rest of the students were either unsure or felt they were ignored entirely. Prolonged response time is one serious flaw in the online mode of teaching. Sometimes students' doubts aren't resolved immediately, which leads to a feeling of helplessness.

College students were also asked to rate how beneficial online classes were for them. Only 3.7 % felt it was excellent. While 31.15 % said it was good, and 17.6 % of students said it was poor. This shows that those who find online classes beneficial are greater than those who felt otherwise, keeping aside the people who chose 'Average' (47.6 %). All these opinions are shown in Fig. 3. However, there is not sufficient data to say whether online classes were better or worse. Comparison with existing literature also doesn't give a full picture as online classes were adopted as an emergency method. A qualitative study assessing student grades, information retention, and student satisfaction for a semester-long session conducted online is currently not available in India. Similar studies in the US have reported mixed results. A study of academic performance of business management students in Huizenga graduate school of business and entrepreneurship, USA, taking the same course online and

offline found no significant difference concerning grades (Simon and Yatrakis, 2002). A more recent study involving undergraduates and professors at DeVry University reports that students perform worse in online classes and their performances are more variable (Bettinger et al., 2015).

This study states that one-to-one interaction might be difficult considering the strength of classrooms in higher education institutes run up to 200. The students expect that the teachers in higher education need to (i) be creative and find new ways to deliver content through online classes to properly engage the students (ii) encourage students to reach out by conducting more peer discussions and efficient use of chat rooms and (iii) involve more teaching assistants to guide and help to alleviate students' doubts and make the learning process more engaging and stimulating.

3.2.5. Evaluation

College students were asked what mode of exams they would prefer if they were to be conducted or if they preferred there to be no exams at all. Students were also given the option to mention any other method they deemed appropriate. As shown in Fig. 4, one-third responded they felt no need for exams. Some of the reasons they mentioned were accessibility problems, lack of study material, insufficient time to prepare and interrupted the learning environment at home. Considering all these inconveniences as legitimate, it would be unfair to those who experience these issues. Another third felt evaluation through assignments should take place, and a combined 30 % leaned towards an objective or open text exams online.

The major challenge in higher education institutes is to come up with better and more efficient methods of evaluation and grading due to the massive enrollment. Evaluation methods need to shift from a memory-based approach to open book methods which are less popular in the Indian Scenario. There is also a need for new technologies for anti-plagiarism to avoid cheating and other malpractices.

3.2.6. Future aspects

Even with the pandemic situation, 1/5th of total students wanted their institutes to reopen, possibly out of concern of the time they are wasting instead of completing their courses. This suggests that students feel the amount of learning is inadequate. When college students were asked whether online classes could potentially replace current classroom teaching methods, 22.1 % of students were in general agreement with this statement, while almost twice the number voiced their disagreement. One-third of the students remained neutral in their opinion. But the current situation highlights how teachers and students in higher education need to look beyond the traditional learning methods and accept modern technologies. Hopefully, this will enable us to realize the potential of online teaching and learning and to use technology more aptly (Dhawan, 2020). It was seen only 9.3 % thought online jobs were more convenient, 51 % reported to prefer working in an office and almost 40 % stating they were comfortable with either (Fig. 5). This indicates that respondents as a whole don't have extreme preference or aversion to the 'online world'. A detailed discussion comparing the school and college students' views is given in Appendix A.

3.3. Teacher's from Lower Education – school teachers' view

3.3.1. Preliminary information

Among the responses from school teachers from different states in India, about 35 % of teachers taught in classes 9 and 10, 23 % in 6–8 classes and the same percentage in 1–3 classes, 10 % in +1-+2/PUC, and the remaining 9% in classes 4−5. Out of the teachers who responded, the percentage of those who taught in schools belonging to the state boards and CBSE were 84.2 % and 15.8 % respectively.

3.3.2. Method of teaching and setting up online classes at home

When the school teachers were asked about the methods that they

adopted for teaching, in such a way that they could choose multiple choices, the majority of teachers (62 %) said they use recorded classes through TV broadcasting, as shown in Fig. 1. This might be because most of the respondents (83.9 %) were from Kerala, where this method was used primarily. The remaining delivered live classes through video conferencing apps such as Google meet, Microsoft Teams, and Zoom. Since all these apps provide free service, classes could be conducted free of cost and were accessible to all. About 91 % of teachers reported that they are taught from home, 7% of teachers are taught from their schools and the rest of them taught from both home and school. About 89 % owned the required devices for conducting online classes, 7% had to purchase new devices for arranging the classes and a few (4%) had their schools sponsored the devices. So, the availability of electronic devices to conduct online classes wasn't a problem for the school teachers compared to the school students. Eight out of ten faced network connectivity problems. Disrupted Electricity (26 %) was the second most common problem followed by a limited data plan (9%) and problems with electronic devices (9%) that denied access to online classes on certain occasions

3.3.3. Level of comfort in online classes

Teachers were asked how many hours of online classes they held each week. More than half (54.9 %) took 3−4 h, whereas 27.5 % taught for 4−8 h and 9.8 % taught for 8−12 h range and the remaining 7.8 % of teachers took classes for more than 12 h. This completely depends on the students to teachers ratio that the school maintains. About 9 out of 10 school teachers felt as regular classes are more comfortable than online classes. Only 3% said online classes are the same as regular classes with none felt online mode as a comfortable platform (Fig. 2). This might be because (i) the teachers are least accustomed to online platforms (ii) need for more time and effort investment in online teaching, and (iii) physical and mental discomfort. This is again proved by the fact that more than half of school teachers (52.7 %) reported having physical (headache, neck pain, numbness of hands, strain in eyes, etc.) and mental discomforts (lack of satisfaction due to the absence of direct contact with students) as a consequence of conducting online classes. Their unpreparedness for the situation and the extra work they had to put in to carry out the classes took a toll on their health, making them vulnerable to the mentioned discomforts. Teachers were also concerned about the influence of their lectures among students since there was a complete absence of immediate feedback from students. An overall dissatisfaction could be sensed among the majority of school teachers, which might be reflected in the quality of education the students receive.

3.3.4. Attentiveness and knowledge transfer

Almost all school teachers (98.2 %) said direct student-teacher interaction is essential for proper learning. This indicates that school teachers place a high value on interaction with students and think that it is a must factor for an effective teaching-learning process.

The efficiency of knowledge transfer was reported to be better in regular classes by 89 %, while 6% had the opinion that the effects of both are the same and 5% could not assess. Considering the attentiveness of students, 92.9 % agreed to regular classes being better while only 3.6 % thought that both were the same. None of the teachers felt that online classes were better in terms of this aspect. They also were asked about the extent to which students interacted with them. As expected, regular classes were voted to be better, as said by 91.8 % of respondents, stated otherwise by only 2%. All these clearly show that school teachers too faced difficulty in communicating with students efficiently. Almost three-quarters of the teachers could not clarify students' doubts to the same extent as in regular classes. Only 1 out of 10 felt online classes were a better platform for clearing doubts. Fig. 3 presents its opinions on these factors.

Although there are previous studies for which students and teachers gave positive feedback for online classes (Seok et al., 2010), the current study gave an opposite view. Lack of preparation, a general conception

that online classes are insufficient and the hurdles that were faced by teachers due to the student's mischiefs during the classes and evaluation may have hampered the effective knowledge transfer. However, the school teacher is one of the communities which is using the available resources to the best in the current situation.

3.3.5. Evaluation

More than half of the school teachers (57.1 %) believe that exams should not be conducted under these circumstances. The pandemic-based inconveniences made the assessment and grading of the students, difficult. Assignments and homework were the most agreed-upon method of evaluation (53 %) since they wouldn't affect the vast majority of students who have difficulty accessing the internet. This study shows that the online exams were not a popular alternative among the school teachers because of changing examination pattern, routines, and the other linked complications, as shown in a study (Kuikka et al., 2014), which also stated that "To get teachers to use e-exam more widely, it is vital to provide support and to reserve enough time for them for the introduction of re-examination". Nevertheless, 33 % agreed on conducting online exams (Fig. 4). While evaluation might not be as important for primary classes, it is important in high school and higher secondary classes and teachers have to find alternative methods for evaluation by making use of all the existing technologies.

3.3.6. Future aspects

The prospect of the complete transition to online classes received more negative responses than positive ones. About 66.1 % were against the idea, while only 26.8 % supported it, and among, 83.6 % said that they would use online resources for teaching in the future, as shown in Fig. 5. This study indicates that the school teachers welcome the idea of digitalizing the classrooms, only if, effective teaching and evaluation methods are provided.

3.4. Teachers from higher education - professors' view

3.4.1. Preliminary information

The results depicted here were obtained from a survey conducted for professors in various institutes in India like the National Institute of Technology (NIT), Indian Institute of Technology), IISERs (Indian Institute of Science Education and Research (IIT), etc. Among the responded professors, 78.7 % are in centrally funded institutes, 12.8 % in autonomous, and 8.5 % in private colleges. The courses being taught by the professors were diverse which includes different branches of engineering, humanities, science, etc.

3.4.2. Method of teaching and setting up online classes at home

All of the respondents in this survey had faced transition to online classes from regular classes. The platforms and methods used were quite diverse, which ranged from using various video-conferencing apps such as Google meet, Google classroom, WhatsApp, MS teams, Zoom, WebEx, Rainbow, etc, and utilizing learning management systems such as Moodle, piazza, canvas, etc. This might have been due to its close resemblance to teaching in a face-to-face classroom (Hrastinski, 2008). Synchronous learning has been found to show many advantages over asynchronous classes, which includes the students being able to interact with teachers and fellow students during real-time online classes, instead of having to work in isolation (Papadima-Sophocleous, and Loizides, 2016). While some professors (34 %) opted to record the lectures, 9% of them tended to rely on various digital courses through the web such as SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds), digital courses through TV such as SWAYAM-PRABHA, e-books, etc. and gave the same as the reference to the students. Out of the total respondents, 64.6 % used their own devices, 20.8 % used the devices from their college and the remaining 14.6 % had to purchase the devices for conducting the classes. The majority of the respondents had network connectivity issues (44 %), followed by nearly 1 out of 5 having

problems with electronic devices (20 %) or disrupted electricity (19 %) (see Fig. 1). Many of the professors were concerned about not receiving proper feedback from the students and felt that was the major hurdle in online classes. All these factors, in turn, may decline the quality of education being provided to the students as well as the moral satisfaction of the teachers from higher education.

3.4.3. Level of comfort in online classes

About 3–4 h of class per week was found to be the most common (54 %) class duration adopted by the professors, followed by 4−8 h (35 %) with a few more than 8 h per week. Nearly, 44 % of the respondents couldn't adapt comfortably to the shift of education to online mode and directly suffered from some kind of mental or physical discomforts. These include headaches, strain in the eyes due to longer time spent in front of computers, backache; lack of motivation to teach, anxiety, and stress. As represented in Fig. 2, the online mode of teaching seemed to be uncomfortable for 87.5 % while only 4.2 % agreed that online classes are better.

Few respondents commented that they had to invest more time and effort into the teaching process which was taxing. Indeed, many studies revealed that time and effort spent on online course development and delivery are greater than that of regular classroom teaching as it involves (i) organizing content, (ii) presenting information that addressed different learning styles, and (iii) providing lecture notes in advance (Conceição, 2006). It was also reported that professors had to face physical and phycological stress due to the following hurdles: (i) less interaction from students who find these classes to be monotonous(ii) demands long sitting and screen time to prepare study material for the students (iii) inadequate training of the faculty for this new mode of teaching, (iv) inability to properly help the students who cannot grasp the concepts properly, and (v) other issues faced because of internet connectivity problems, lack of laboratory courses, etc. from the students' side.

3.4.4. Attentiveness and knowledge transfer

An overwhelming 95 % of them agreed upon the importance of direct student-teacher interaction in a class. Although a few neutrals, none of the professors entirely rejected this view (Fig. 3). This indicates that almost all the professors were not satisfied with the current online classes. Since positive student outcomes are highly correlated with faculty satisfaction (Hartman et al., 2000) and faculty satisfaction is considered as one of the five pillars of quality, together with student satisfaction, learning effectiveness, access, and institutional cost-effectiveness, it could also be a determinant of the success of the online classes (Sloan Consortium, 2002).

Concerning the attentiveness and knowledge transfer during the online classes, professors had the following opinions compared to regular classes: Predictably, opinion about the efficiency of online classes was also not positive with three-quarters of the respondents agreeing that regular classes were better in terms of efficiency in knowledge transfer from a teacher to students. An equal percentage believed that students were less interactive in an online class than in a regular class. A similar study stated that online instructors experience limited interaction with students whether the class is taught synchronously or asynchronously in online mode (Bower, 2001). Also, the majority (76.6 %) reported that students in online classes were less attentive.

Professors felt that they were unable to communicate efficiently with students in an online environment. More than half of them (58.3 %) couldn't clarify students' doubts better than in a regular class. Many of them were worried about the complete absence of an immediate response from the students, which made them unable to evaluate the effectiveness of their lectures. Another study also showed that the immediacy of communication between instructors and students and between students is a critical success factor for effective online learning (Vonderwell, 2003). Delay or interruption of communication can decrease student's motivation which is the underlying effectiveness of

knowledge transfer. In online mode, there is a compulsion for professors to engage their students beyond the lectures.

To have successful online classes in the higher education system, communication is key and should be promoted between students and teachers (Cavanaugh et al., 2004). Online learning environments, when designed to fully use the many available tools of communication, are often a more active, constructive, and cooperative experience than regular classroom learning

3.4.5. Evaluation

Considering all the inconveniences in the evaluation, 52.1 % agreed that exams should be conducted under these circumstances, while the remaining preferred for exams to be not conducted. The method of evaluation preferred was found to vary from person to person. Assignments and homework were the most agreed upon (39 %) method of evaluation since they wouldn't affect the vast majority of students who have difficulty accessing the internet. However, these are not adequate and efficient ways in which students can be evaluated. The current situation might be the reason behind the majority choosing this option. Nevertheless, 29 % concurred with the idea of conducting online exams. The second most preferred choice was conducting viva (31 %). Fig. 4 presents its evaluation opinions.

3.4.6. Future aspects

When asked for their opinion regarding the future aspects of online classes, 29.2 % agreed with the idea that online classes could potentially replace regular classes, 58.3 % disagreed with the idea, while 12.5 % chose to remain neutral. They were also asked whether they would use such online resources in the future of which 77.1 % thought they will and the remaining 22.9 % said no (Fig. 5). Although the odds do not seem to be in favour of online classes, it conceals vast potential, which we can hopefully make use of one day. The negative feedback received for online classes can be traced back to the lack of preparedness of students and teachers, as no one had foreseen how much importance it would acquire during the lockdown period. A three-quarter of the total professors saying they would use such online resources in the future gives hope for further development and utilization of online courses. Once the teachers get comfortable with this mode of education, the results might gradually incorporate it as 'blended courses' and move forward towards online learning.

A detailed discussion comparing the school and college students' views is given in Appendix A.

3.5. Challenges, opportunities, and way forward

There are numerous advantages and potential in online classes for both teachers and students. It is entirely possible to deliver the same quality of education through web-based resources with almost the same level of success. In the current era, it is also vital that students develop technology-based reasoning and communication skills as going online is the new norm be it for education or a job. Virtual classes also have positive impacts on students. It requires them to develop independent and critical thinking, problem-solving, decision making, and time management. Quality of interaction in online classes will increase once teachers can effectively use technology and educational institutions develop their technological infrastructure. This study found a certain amount of stress (physical and mental) on both students and teachers much of which can be eliminated by getting used to this mode and by setting up classes in a way that is comfortable to all the parties. Lack of student-teacher communication is also a major challenge faced by students and teachers from both lower and higher strata of education. Proper channels of communication between students and teachers need to be set up so that students can clear their doubts and have more interaction within the online learning environment. Network connectivity problems also pose a major hurdle for effective communication.

Students need to take advantage of the vast resources on the internet

available to them and explore new dimensions of learning. Taking time to learn things in this new way might prove beneficial to them. Perhaps online classes are more challenging for teachers than students as they had to come up with different methodologies for teaching and had to invest more time and effort than teaching in a regular classroom. Developing and creating content that fits in the curriculum as well as engaging students through the virtual environment might prove to be difficult. There also exists a major problem of technological constraints which deepened the digital divide in India (Anab, 2020). This divide between students who are not able to access the technology and those who have must be brought down. Internet penetration levels in India stood at only 40 % compared to 88 % in the US and 61 % in China (Statista, 2020). 2100 government colleges in India do not have Wi-Fi facility and 9 million (90 lakh) students in government institutions may not be able to access online education due to electricity problems or the unavailability of the smartphone or laptop. Institutes need to have the necessary technologies which will enable the teachers to reach out to their students. Not a single student should be left out of these online classes. Thus, the development of basic technological infrastructure should be made a priority. The pandemic may prove to be useful in reassessing various aspects of the education system.

Evaluation methods may be modified to fit the current scenario in a way comfortable to students within the technological constraints. The current situation might help us to focus on the aspect of the importance of quality of education and not the quantity. Governments need to understand the importance of online learning and promote their growth by identifying key areas and underlining strict guidelines that will ensure all students benefit from these methods. The new laws and guidelines could make online education more effective by providing better online platforms and by addressing problems faced by teachers and learners. Higher education institutions need to seize these opportunities to strengthen data monitoring, documentation, and evidence-based practices of the services and programs that are offered to the students (Toquero, 2020). This is also a good opportunity to account for the lack of sufficient literature regarding online learning systems in India.

With the reopening of educational institutions still looking like a far-away prospect, the only alternative is to offer online classes. Teachers should find ways to engage students and encourage them to clear doubts. Institutions have a responsibility to make sure they reach out to all their students, address their concerns, and guide them. Even parents should make sure their children participate in these activities. While it might be certainly inadequate, students need to find ways to use the resources available to them in the best possible way. Students have a right to an education that should not be avoided. While there is great potential, in improving this aspect of learning, there seems to be a need for more exposure for students to these technologies and teachers need to find more efficient ways of using them.

4. Conclusion

Although COVID 19 pandemic struck hard in every walk of life, teachers and students resumed their journey soon by setting up emergency remote learning platforms using various online collaborative tools in hand, even without a pre-planned course structure or proper training to teachers or students for adapting to the change. Both the learners' group and teachers group were predominantly in favour of regular classes. Most felt regular classes were better in terms of efficiency, interaction, and overall understanding. Although there is some level of comfort in learning/teaching from home, various technical issues and the extra effort one has to put in make the process taxing on students and teachers.

Although most of the responses tilted in favour of traditional learning, we can presume that this was because of the unprecedented circumstances and the lack of preparation of teachers and students towards shifting to this mode of learning. Online education has the potential to dominate the educational field if a proper initiative is taken

from the government and authorities of educational institutions. The evolution of online learning and its widespread use has always been envisioned in previous studies (e.g. Kim and Bonk, 2006), and these days, a vast number of choices are available to us regarding online courses in every subject and field. Shifting to online classes has numerous advantages like reduced travel costs, saving time, and access to education for those in remote places (James, 2002). Hence, we can hope that online learning gets the attention and the resources it needs to thrive and will be of much importance in the future of education. The significance of this study lies in its in-depth understanding of teachers' and learners' perceptions of online classes, which immediately seeks government attention to mitigate the deficits and to ensure an effective online learning platform in the future, temporarily or permanently.

- The learning group and the teaching group reported regular classes are better in terms of knowledge transfer and learning efficacy.
- Even among the general negative feedback, few students reported they were more attentive in online classes, probably owing to favourable situations at home. This highlights how learning environments can influence the quality of online learning and teaching.
- Students and teachers are facing many physical and mental discomforts during these tough times which affect the learning and teaching process. Any such issues should be handled sensitively.
- The aspect of communication and clearing doubts should be made more effective. Platforms that help with this are not used adequately and need improvement.
- There is a need for more investment in technology and basic infrastructure which will ensure uninhibited access to online classes for students and teachers belonging to all strata of society.

There are existing studies about the effectiveness of online classes in distance education courses or other student or teacher training programs. However, very little is known about similar programs or online mode of education in India. The circumstances of this study are also unique considering the shift to online classes happened overnight with no preparations whatsoever. The survey addresses a wide range of topics related to online classes including the quality of learning environments and physical or mental stresses which are relevant to this time. The direct input we received from students and teachers from schools and colleges across the country will help analyze the key areas where improvement is needed. This study will hopefully act as a foundation to future studies on a much larger scale on the aspects this study has discussed which will enable us to access a new frontier in the educational sector.

CRediT authorship contribution statement

Ambika Selvaraj: Conceptualization, Methodology, Visualization, Investigation, Supervision. **Radhin Vishnu:** Data curation, Writing - original draft, Writing - review & editing. **Nithin KA:** Data curation, Writing - original draft, Writing - review & editing. **Noel Benson:** Data curation, Writing - original draft, Writing - review & editing. **Arun Jo Mathew:** Data curation, Writing - original draft, Writing - review & editing.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the

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