

# Original Research Article

## **The Effectiveness of Online Teaching-Learning System: A Study based on the Experiences of UG Students during the COVID-19 Pandemic**

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### **ABSTRACT**

This paper attempts to study the effectiveness of online mode of teaching-learning system based on a statistical survey on the experiences of 545 UG students of some colleges (affiliated to the University of Calcutta) of Kolkata, India, who attended online classes during the COVID-19 pandemic. The Chi-square test of independence is used to study the roles of gender, programme of study and residential location of the students in the usefulness of online mode of teaching. The results indicate that gender, residential area and programme of study were significant factors determining usefulness of the online mode. The female students reported more about the negative aspects of online classes like logistic and physical problems compared to the male students but the aspects like level of satisfaction, motivation for study, self-study inclination, better understanding etc. were positively conveyed by the female students. The students from rural area seemed to lack motivation for study, self-study inclination, better understanding etc. more compared to those from urban area. Further, it is revealed that online system led to more inclination towards self-study and enhanced level of understanding. But decrease in motivation for study and lack of interaction with the teachers were common responses of the students.

*Keywords:* Online teaching, Online learning, Blended teaching, COVID-19, Chi-square test of independence

### **1. INTRODUCTION**

Online mode of teaching is suggested as an integral part of modern teaching system.[1] The University Grants Commission recommended for blended teaching mode where up to forty per cent of syllabus would be taught in online mode and remaining sixty per cent in offline mode.[2] Blended teaching is a well-planned combination of technology based online classes and traditional face-to-face classes. The most important advantage of online mode lies in its flexibility for both the instructors and the students. Classes can be held by the teachers and attended by the students at any time and from any place of the world provided that computers or smart phones and internet connections are available. There may be other advantages like effective use of timing of direct teaching, better understanding, flexibility of using study materials at the convenience of students leading to improved students' satisfaction, learning skills and learning outcome. [3]

Recently, during the COVID-19 pandemic the educational institutions were forced to shut down. But the education system still sustained by completely switching over to online mode

of teaching. The institutions which were using this method prior to pandemic could manage it successfully whereas the others had to cope with the system gradually. It is suggested that this online mode should be a part of teaching methods even when the educational institutions are open.

Moore, Dickson-Deane, Galyen and Chen (2010) clarified the terms viz., distance learning, e-learning and online learning which are various modes of learning.[4] Barr and Miller (2013) described the strengths and weaknesses of online teaching-learning method.[5] Sadiku, Abedo and Musa (2018) focused on the opportunities provided as well as challenges faced by online education system.[6] Dhawan (2020) conducted a Strengths, Weaknesses, Opportunities and Challenges (SWOC) analysis of e-learning system implemented during the pandemic crisis.[7] Howell (2001) suggested some ways by which the negative aspects of online learning like feeling of isolation by the students, lack of motivation for study could be addressed.[8]

Based on a case study on Peking University Bao (2020) suggested the strategies to be adopted by the teachers to make online teaching fruitful.[9] Analysing the responses of 762 students of two of the largest Universities in Romania Coman, Tiru, Mesesan-Schmitz, Stanciu and Bularca (2020) identified technical issues, lack of technical skill of the instructors, lack of student-instructor interactions as the main disadvantages of the online learning pointed out by the students. Decrease in motivation for study and feeling of isolation due to lack of physical presence of class mates were common issues among the students. [10]

Sagdeb-Tehrani (2009) identified some advantages and disadvantages of online distance learning on the basis of the responses of students participating in an online MBA course.[11] Arbaugh (2006) examined the role of teaching approach on the effectiveness of online mode of teaching. Group learning technique is advocated as students can learn through group activities better compared to individual learning. Based on a study covering MBA students of a US university this paper compared various teaching techniques and the results supported the view that group learning approach was better for online mode of teaching also.[12] Embi (2014) provided a comprehensive study of various aspects relating to online learning including the case studies on various online courses taught in several universities of Malaysia.[13]

Schroeder-Moreno (2007) conducted an experiment where an introductory turfgrass management course was taught using online and offline modes to different sections of students with similar level of knowledge on the subject at the beginning. The content of the course was same for both. But students opting for online course were not required to attend offline classes and the students opting for offline course did not have access to online course materials. Evaluating the performance of all students it was found that online mode was equally effective like offline mode.[14] A similar survey was conducted by Ni (2013) on the students of a public administration programme at the California State University. The results of this study indicated that the students' performance was not dependent upon the teaching mode. [15]

Nollenberger (2015) attempted to assess students' preference for totally online courses, totally offline courses and a hybrid course for a mid-West university. The survey revealed that although students preferred online courses for their flexibility, they were eager to interact with the instructors and other students physically.[16] In the survey done by Bergstrand and Savage (2013) the students of sociology preferred face-to-face classes and noted that the negative aspects of online classes varied from one teacher to another.[17] Riffell and Sibley (2003) on the basis of their survey argued that a hybrid mode of teaching was preferred to the traditional method by the students of a course on applications of environmental biology because in that it was possible to take the advantages of online method while retaining the positive aspects of traditional method.[18] Alqahtani and Rajkhan (2020) opined that the success of online system of study of institutions may be different for those which implemented it after COVID-19 pandemic and those which had been using the system

before pandemic. Because, the institutions, which used it for the first time, were not well prepared with adequate infrastructure like others. Their study covered sixty nine educational institutions of Saudi Arabia. Considering the criteria viz., characteristics of the instructors and the students, information technology, technological knowledge etc. the study identified significant factors on which the success of online learning was dependent.[19] Based on the responses of 544 students studying business management or hotel management courses in the Indian Universities Gopal, Singh and Aggarwal (2021) examined the roles of course design, quality of instructor, prompt feedback from the instructor and students' expectation as significant factors determining students' satisfaction in online classes.[20]

The review of the literature notes that the effectiveness of various teaching modes has been examined for students as a whole. The roles of gender and residential location of the students on their responses are not explored. In this paper we attempt to deal with that aspect.

The objective of the present study is to examine the effectiveness of online teaching mode from the point of view of the under-graduate students of some colleges situated in Kolkata, India. The survey is based on the experiences of 545 students of 15 colleges. The students covered under the study can be grouped according to gender, location of their residence viz., rural and urban, programme of study viz., B.A., B.Sc., B.Com., B.B.A. and B.Ed., and the profession of their parents viz., farming, service, self-employment and others. The effectiveness of online mode of teaching-learning system is examined considering various indicators like whether the students are satisfied or not and if satisfied, what is the level of satisfaction, whether online mode provides better understanding, more self-study inclination, enhanced motivation for study, more interaction with the teachers etc. Since, it is often complained that logistic problems can hinder the success of online mode, students are asked about their experiences on occurrence of such problems. Incidents of some physical problems like headache and eye problem after attending online classes is also considered as a relevant issue. Further, it is examined whether the responses are associated with gender, residential location, programme of study etc.

The paper is organized as follows. Data and methodology are described in Section 2. Section 3 analyses the responses of the students to study the effectiveness of online mode of teaching-learning and the roles of gender, residential location, programme of study and profession of the parents of the students on their experiences. Some concluding remarks are made in Section 4.

## **2. DATA AND METHODOLOGY**

In September 2020 the link of the google form of the questionnaire<sup>1</sup> was circulated among the students of some undergraduate colleges under the University of Calcutta. The first set of questions seeks to get the information on the characteristics of the respondents like gender, location of residence, programme of study etc. The second set of questions focuses on the negative aspects of online mode of education viz., prevalence of logistic issues and physical issues. The third set of questions tries to search the information on effectiveness of this mode of teaching on the basis of students' satisfaction, level of understanding, motivation for study etc. The questionnaire also includes the suggestions given by the respondents to make online teaching effective. The data for the present study were collected from the responses received. Out of 546 responses received one respondent did not prefer to disclose his/her gender; discarding this response we have taken 545 responses for our study. It is noted that 99.26 per cent of the students attended online classes during this period and on an average, they attended two hours of online classes per day. The students can be classified according to four criteria, viz., gender, residential area, parental

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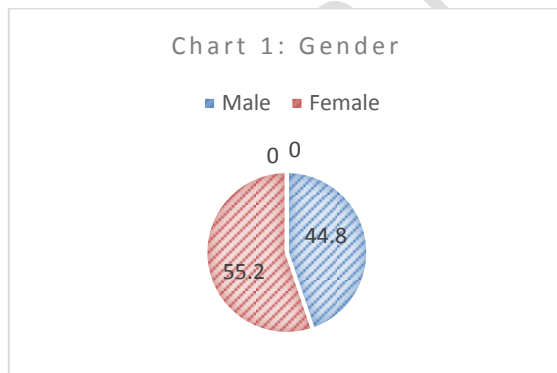
<sup>1</sup> The questionnaire is included in the Appendix.

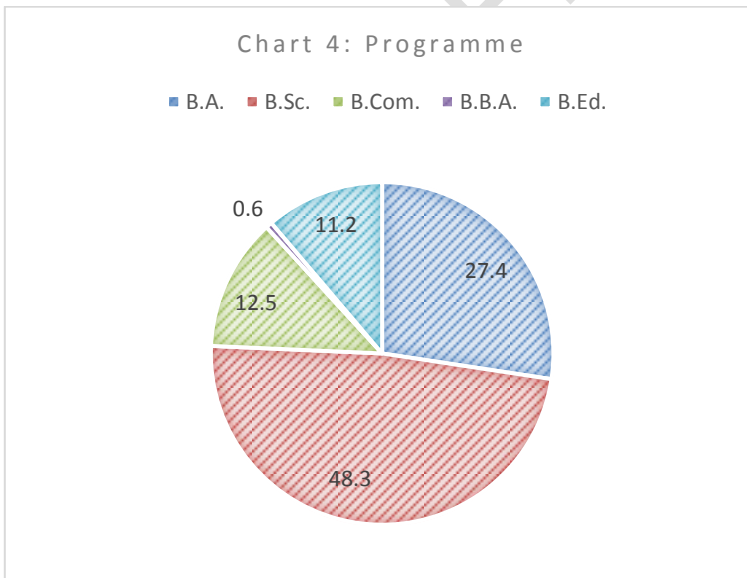
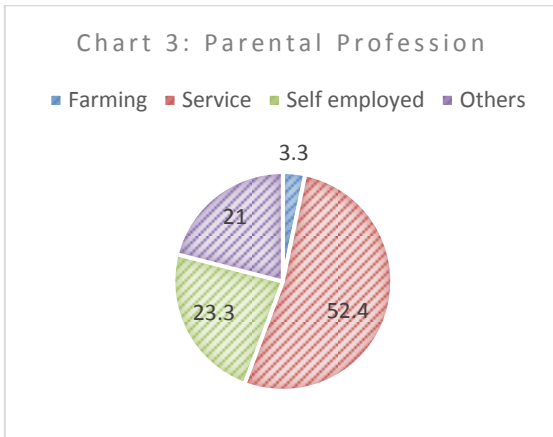
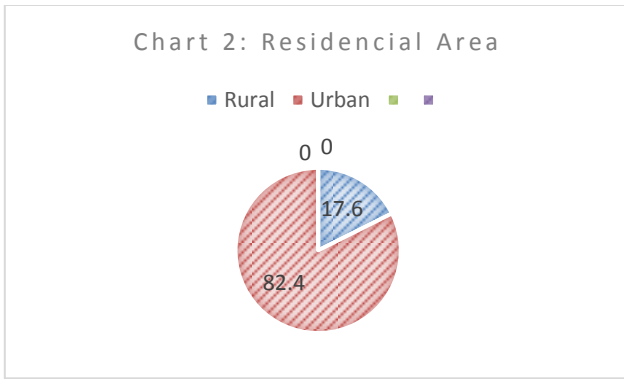
profession and the programme of study. We have considered various indicators for studying effectiveness of online method of study like the issues of logistic problems associated with online method of teaching-learning, incidence of physical problems like headache or eye problem after attending online classes, whether a student is satisfied with this system and if satisfied, the level of satisfaction, whether this method is more interactive and it needs more attention, leads to enhanced motivation for study and increased self-study inclination. The responses of the students regarding these issues are collected.

The classical statistical method of Chi-square test is used to examine whether an indicator and a criterion of classification of the students are associated. For example, to test whether responses (Yes or No) to a particular question and gender are associated our null hypothesis is that gender and responses are independent. Under this null hypothesis the test statistic follows a Chi-square distribution with 1 degree of freedom. Comparing the P (p-value) with the pre-assigned level of significance of five per cent we take decision regarding rejection and non-rejection of the null hypothesis and conclude accordingly. We also examine whether the proportions of students responding positively to a question are significantly different for male and female students. The concerned null hypothesis is that those proportions are not different and under this null hypothesis the relevant test statistic follows a t distribution. Comparing the Ps with the pre-assigned level of significance the null hypothesis is rejected or not rejected. Similar tests are conducted for other indicators and for other classifications of the students also. Software stata is used to conduct the study.

### 3. RESULTS AND DISCUSSION

Although the study is based on the responses of the students studying in the colleges situated in Kolkata only, there is diversity among them on the basis of gender, location of residence, parental profession and programme of study [Charts 1 – 4].





We now attempt to analyze the data on students' responses regarding their experiences on online learning. Table 1 presents the summary of responses to the questions. It is noted that more than sixty per cent of the students complained about physical problem and sixty per cent of them faced logical issues while attending to online classes. But almost seventy per

cent of them were satisfied with the system. More or less seventy per cent students thought that online system enhanced their level of understanding and self-study inclination. But motivation for study increased for about one-third of the students only and about sixty five per cent students thought that this system was not more interactive with their teachers.

**Table 1. Summary of Responses**

Subject	Response (%)		
	Yes	No	Other
Having physical problem after attending online classes	63.24	36.76	
Facing logistic problem in attending online classes	59.93	40.07	
Satisfied with online system of learning	68.93	31.07	
Increase in motivation for study in online method	31.43	34.38	34.19
Needing more attention in online learning	67.28	32.72	
Better understanding in online method	68.93	31.07	
Feeling more interactive compared to offline method	35.29	64.71	
Leading to more self-study inclination in online learning	71.88	28.13	
Source: The Author			

### 3.1 GENDER AND INDICATORS OF EFFECTIVENESS

In this sub-section we try to examine whether the responses on occurrence of logistic issues, physical problems, effects on motivation for study, level of satisfaction, level of understanding etc. are associated with gender of the students. For each of these indicators we also have examined whether the proportion of students responding 'yes' is significantly different for male and female students.

The results of all tests relating to association of gender and the indicators are presented in Table 2. It is observed that the indicators viz., responses to health issue, motivation for study, better understanding and more interactive method in case of online mode may be associated with gender.

**Table 2. Results of Tests of Independence of Gender and Indicators**

Null Hypothesis ( $H_0$ )	$P$	Decision at 5% level of significance	Remark
Gender and Response to health issue are independent	0.043	$H_0$ is rejected	Gender and response to health issue may be dependent

Gender and Response to logistic issue are independent	0.458	$H_0$ is not rejected	Gender and response to logistic issue may be independent
Gender and Response to whether satisfied are independent	0.057	$H_0$ is not rejected	Gender and response to whether satisfied may be independent
Gender and Level of satisfaction are independent	0.818	$H_0$ is not rejected	Gender and level of satisfaction may be independent
Gender and Response to motivation for study are independent	0.03	$H_0$ is rejected	Gender and motivation for study may be dependent
Gender and Response to whether more attention is needed are independent	0.343	$H_0$ is not rejected	Gender and response to whether more attention is needed may be independent
Gender and Response to better understanding are independent	0.014	$H_0$ is rejected	Gender and response to better understanding may be dependent
Gender and Response to more interactive are independent	0.018	$H_0$ is rejected	Gender and response to more interactive may be dependent
Gender and Response to self-study inclination are independent	0.943	$H_0$ is not rejected	Gender and response to self-study inclination may be independent
Source: The Author			

We have conducted tests for comparison of proportions of male and female students who responded 'yes' to the indicator for all cases. The results indicate some interesting aspects. First, the proportion of female students reporting physical problem may be significantly more than that for male students ( $P = 0.001$ ); second, the proportion of female students reporting logistic problem as an issue for online learning may be significantly more than that for male students ( $P = 0.0105$ ); however, null hypotheses of equal proportions for male and female students facing device problem ( $P = 0.3621$ ) and financial problem ( $P = 0.5$ ) are not rejected, and so, no significant difference in the proportions may be there. On the other hand, there is evidence of higher proportion of students who are satisfied with the online learning system for female students compared to the male students ( $P = 0.0013$ ). Regarding level of satisfaction, it is observed that among the students who are moderately satisfied and satisfied the proportions of female students may be significantly higher than those for male students (the corresponding p-values are 0.0407 and 0.0271 respectively), whereas for the students who are very much satisfied the proportions of male and female students may not be significantly different ( $P = 0.3818$ ); the proportion of students for whom motivation for study has increased in this system may be significantly higher for female students compared to male students ( $P = 0.0044$ ); the proportion of students who think that more attention is needed in online mode may be significantly more for female students compared to male students ( $P = 0.0064$ ); the proportion of students who think that online learning has led to better understanding also may be significantly higher for female students than for male students ( $P = 0.0005$ ); regarding students feeling online system to be more interactive and enhanced self-study inclination also the proportion may be significantly higher for female students compared to male students (p-values are 0.0006 and 0.0197 respectively).

### 3.2 RESIDENTIAL AREA AND INDICATORS OF EFFECTIVENESS

We now attempt to examine whether the responses on these characteristics are associated with residential areas of the students. For each of these characteristics we have examined whether the proportion of students responding 'yes' is significantly different for students living in rural and urban areas. Table 3 shows the results of this study. It is noted that incidence of logistic problem and physical problem are not associated with the residential area of the students although frequency of network disconnection is associated with residential area. Regarding the responses on the indicators like level of satisfaction, motivation for study, self-study inclination there is evidence of their association with the residential area.

**Table 3. Results of Tests of Independence of Residential Area and Indicators**

Null Hypothesis ( $H_0$ )	P	Decision at 5% level of significance	Remark
Residential area and Response to health issue are independent	0.76	$H_0$ is not rejected	Residential area and response to health issue may be independent
Residential area and Response to logistic issue are independent	0.138	$H_0$ is not rejected	Residential area and response to logistic issue may be independent

Residential area and Frequency of disconnection are independent	0.001	$H_0$ is rejected	Residential area and frequency of disconnection may be dependent
Residential area and Response to whether satisfied are independent	0.003	$H_0$ is rejected	Residential area and response to whether satisfied may be dependent
Residential area and Level of satisfaction are independent	0.02	$H_0$ is rejected	Residential area and level of satisfaction may be dependent
Residential area and Response to motivation for study are independent	0.775	$H_0$ is not rejected	Residential area and motivation for study may be independent
Residential area and Response to whether more attention is needed are independent	0.02	$H_0$ is rejected	Residential area and response to whether more attention is needed may be dependent
Residential area and Response to better understanding are independent	0.658	$H_0$ is not rejected	Residential area and response to better understanding may be independent
Residential area and Response to more interactive are independent	0.15	$H_0$ is not rejected	Residential area and response to more interactive may be independent
Residential area and Response to self-study inclination are independent	0.024	$H_0$ is rejected	Residential area and response to self-study inclination may be

			dependent
Source: The Author			

On the other hand, the proportion of students complaining about logistic and physical problems is significantly less for students from rural area compared to those from urban area (P is 0.0000 for each case). Surprisingly, the proportion of students reporting about the problem of network disconnection is significantly less for rural area compared to urban area (Ps are 0.0051 and 0.0000 respectively for 'very often disconnected' and 'sometimes disconnected'). The study shows evidence of the proportions of students who are satisfied, who are very much satisfied, who are more motivated to study, who acquire better understanding, who are more inclined to self-study to be significantly less for students from rural area compared to those from urban area (P is 0.0000 for each case).

### 3.3 PROGRAMME OF STUDY AND INDICATORS OF EFFECTIVENESS

A similar kind of study is made classifying the students according to their programmes of study. Table 4 presents the results. It is observed that incidences of logical and health issues are not associated with the programme of study, which is natural. But whether the students are satisfied with online classes, motivated more for study, acquire better understanding etc. are linked to the programmes of study.

**Table 4. Results of Tests of Independence of Programme of Study and Indicators**

Null Hypothesis ( $H_0$ )	P	Decision at 5% level of significance	Remark
Course of study and Response to health issue are independent	0.401	$H_0$ is not rejected	Course of study and response to health issue may be independent
Course and Response to logistic issue are independent	0.899	$H_0$ is not rejected	Course and response to logistic issue may be independent
Course and Response to whether satisfied are independent	0.007	$H_0$ is rejected	Course and response to whether satisfied may be dependent
Course and Level of satisfaction are independent	0.109	$H_0$ is not rejected	Course and level of satisfaction may be independent
Course and motivation for study	0.000	$H_0$ is rejected	Course and motivation for

are independent			study may be dependent
Course and Response to whether more attention is needed are independent	0.361	$H_0$ is not rejected	Course and response to whether more attention is needed may be independent
Course and Response to better understanding are independent	0.000	$H_0$ is rejected	Course and response to better understanding may be dependent
Course and Response to whether more interactive are independent	0.000	$H_0$ is rejected	Course and response to more interactive may be dependent
Course and Response to self-study inclination are independent	0.191	$H_0$ is not rejected	Course and response to self-study inclination may be independent
Source: The Author			

### 3.4 PARENTAL PROFESSION AND INDICATORS OF EFFECTIVENESS

Here we try to examine whether such responses are associated with the nature of family the students belong to. Profession of the parents of the students is used as an indicator of the nature of the family. Table 5 shows that the indicators of effectiveness of online learning method are not associated with the parental profession.

**Table 5. Results of Tests of Independence of parental Profession and Indicators**

Null Hypothesis ( $H_0$ )	P	Decision at 5% level of significance	Remark
Parental profession and Response to logistic issue are independent	0.292	$H_0$ is not rejected	Parental profession and response to logistic issue may be independent
Parental profession and Response to whether satisfied	0.312	$H_0$ is not rejected	Parental profession and response to whether

are independent			satisfied may be independent
Parental profession and Level of satisfaction are independent	0.119	$H_0$ is not rejected	Parental profession and level of satisfaction may be independent
Parental profession and Response to motivation for study are independent	0.757	$H_0$ is not rejected	Parental profession and response to motivation for study may be independent
Source: The Author			

Finally, it is found that forty six per cent of the respondents did not give any suggestion for improvement of the online system of teaching-learning; fifteen per cent of them thought that no suggestion was needed because teachers already put adequate efforts to run the online system. Five per cent students precisely mentioned that online system may be an alternative to conventional mode of teaching only under pandemic crisis. About online classes students preferred interactive (6%) and live (3%) lectures not just power point presentation and narration. The major suggestions included uses of better audio and video platforms (1%), teaching aids like electronic pens (5%), sharing of class recordings (5%), and reduction in duration of classes (5%).

#### 4. CONCLUSION

In the present paper we attempt to examine the effectiveness of online method of teaching-learning during the COVID-19 pandemic. It is also studied whether the responses of the students on various indicators of effectiveness of online teaching-learning mode are associated with gender, residential areas, programmes of study and parental professions of students. The experiences of 545 undergraduate students who attended online classes during COVID episode are surveyed.

The study as a whole indicate that majority of the students covered under the study were satisfied with the system and for most of them online system led to more inclination towards self-study and enhanced level of understanding. But for about one-third of them motivation for study decreased and majority of them did not think that this mode led to more interactions with their teachers.

The results of the study also indicate that gender, residential area and programme of study were significant factors on which the usefulness of the online teaching-learning mode was dependent. Parental profession was not found to be an important aspect.

Regarding gender it is found that although the female students reported more about the negative aspects of online classes like logistic and physical problems compared to the male students but for them the aspects like level of satisfaction, motivation for study, self-study inclination, better understanding etc. were positively conveyed. Thus, in general it is found that the effectiveness of online teaching-learning method may be different for male and female students.

Regarding device problem and financial constraint as causes of logistic issues no significant difference between proportions of male and female students is noted. This may be regarded

as an absence of any gender discrimination regarding availability of device and financial support for attending online classes. Conducting the same studies for rural and urban areas separately also we find that there is no evidence of significant difference in proportions of male and female students facing device or financial problems. So, on the basis of this we may conclude that female students were not discriminated at least regarding availability of means for attending online classes in the rural and urban areas separately also.

It is often complained that since online mode of teaching is dependent on the availability of uninterrupted network connection students from remote areas may suffer. Our study, however, does not reveal that. Rather, students from urban area seemed to suffer this problem more. One of the possible reasons might be that the students living in rural area covered under the study were mostly not from remote villages and / or they attended the online classes from some other places. On the other hand, students from rural area seemed to lack motivation for study, self-study inclination, better understanding etc. This result definitely has serious implications for the use of this mode of teaching.

Our study indicates that the programme of study is an important factor determining the effectiveness of online mode of learning. The subject matter, the teaching strategies, orientation of the students etc. are different for various programmes. So, it is possibly the reason behind this association.

Family income may be a factor on which availability of means for device and data needed for attending online classes by the students. We have used parental profession as an index of affordability. Our study does not show any evidence of association between parental profession and any indicator of effectiveness of online learning method.

All the factors determining the effectiveness of online courses are to be explored further in order to make online mode of teaching meaningful. The feedbacks from the students are also to be reviewed periodically in order to minimize the limitations of the system. Otherwise, teaching will be merely 'course delivery' as pointed out by Chisholm (2006).[21] During an emergency situation like epidemic or pandemic this method is definitely helpful in order to run the education system as far as possible; but there are many other stuffs of learning like socialization, empathy, responsibility, discipline, leadership quality etc. which can be better developed in face-to-face classes. So, it may be said that a blended mode of teaching will be better to take the advantages of both online and offline systems.

The study may be extended further by increasing the sample size and including many other related aspects. The students of colleges in Kolkata are covered under the study. The responses of students from remote areas and other disciplines must be included. The study may cover the experiences of students at school level and University level. We have considered the point of view of the students only. For a comprehensive study experience of the teachers are also important. For example, in a physical class a teacher may feel the pulse of the students regarding their level of understanding of the matter and may proceed to it further. Lacking this facility of offline classes definitely affect the learning outcome. Therefore, it can be said that an extensive survey is needed before coming into any general conclusion.

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